Editorial

REACTION to the increased sales tax on radio receivers and components has been almost universally one way. The industry as a whole was deeply wounded at the classification of radio as a luxury, and expressed its ideas with such force that responsible Ministers were obliged to explain that their intention was to define radio as non-essential rather than luxury.

The distinction is a fine one, and did little to ease the position. The trade still considers radio receivers a necessary part of our modern life, and that they already bear as much loading in one way or another as they should be expected to.

Frankly I agree with the radio trade. There seems little real justification for loading receivers with such a severe increase except possibly on the reasoning that some items had to carry extra tax and radio was an unlucky one. I really don't think it is enough to class radio as non-essential and then use that classification to bump up the tax. I'd like to see a little more reasoned statement, because if there has been reasoned judgment, there should be no difficulty in making a good case for the extra tax.

So much for receivers. As regards the tax on receiving components, the situation is tragically comic.

The trouble is that one cannot define a receiving component.

A public address amplifier is not a receiver. Nor is a multi-meter, a test oscillator, an oscillograph, a transmitter, nor a hundred other radio devices I could name. Yet all these things use precisely the same components as are used in receivers. If you were to buy them in a radio store, most of them would come from the same bin.

Now the devices I have listed are not subject to the extra tax, nor are the parts to make them. In fact, I have actually been through a complete radio store catalogue without finding more than half-a-dozen types of components which could fairly be said to be exclusively receiving.

Moreover there are many buyers who do not know at the time of purchase where their components will be used. A serviceman who buys resistors and condensers, in 100 lots, for instance, cannot say whether they will be used to repair sets, build amplifiers, or repair his own test gear, which, by the way, is far from being a luxury. So many radio units are essential tools of trade.

I don't know the answer to all this. But I do know that the longer the absurd position persists, the more hostile radio men will become toward those who allow it to continue.

John Moyle

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RADIO AND HOBBIES IN AUSTRALIA

A NATIONAL MAGAZINE OF RADIO, HOBBIES AND POPULAR SCIENCE

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OUR COVER PICTURE

As a change, we present this month an extremely attractive holiday picture with the wish that the turn of the year will bring you also sunshine and happiness.

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COMPLETE RECEIVER FOR T.V. COLOR

A typical American receiver for the Columbia Broadcasting System color television which has been accepted by the F.C.C. for introduction in America. Sets similar to this will soon be available in well-known brands. C.B.S. does not itself manufacture receivers, but operates a large radio network and has developed a mechanical system of color TV. An explanation of the C.B.S. TV system is given in the following pages.

America Gets Color Television

If an entry in a minute book means anything, the US now has an official system of color television. However, the recent FCC decision in favour of CBS color has raised a storm which is without precedent in US radio history. On-the-spot observers are tipping inquiries and litigation which may well strike at the foundations of the FCC itself.

INSTITUTED by Act of Congress, the Federal Communications Commission has complete authority in the US over technical matters relating to radio communication and broadcasting. It has power to define standards, grant licences, and, if need be, to cancel them. Its prime obligation is to conduct broadcasting "in the public interest."

Right now, the Commission's interpretation of this key clause is under fire. While some are applauding its purposeful attitude, the bulk of the US radio trade has apparently branded the decision as the worst possible one it could have made. What's more, they are preparing to fight it with all the resources they can muster.

INDUSTRY'S OPPOSITION

New York reports state that, in the fight which must ensue, the FCC and the Columbia Broadcasting System will find themselves allied and pitted against the entire resources of the television industry.

The Radio Corporation (RCA), which has a big stake in the all-electronic system, is prepared to fight the FCC decision right through, if need be, to the Supreme Court. Philco has taken similar and independent action, while the big Television Dealers' Association is seeking an injunction.

Representations have been made in Congress, and it appears certain that the broad discretionary powers of the FCC will be re-examined in the light of the television controversy.

PUBLICITY

Meanwhile, the major television manufacturers have agreed to contribute 1,000,000 dollars between them to point out the limitations of CBS color receivers and encourage the public to buy the current models. They have already come to light with big full-page adverts, plugging the story.

But, if Columbia can win out and force public acceptance of color, it will be in a very strong position. The enormous amount of research which their engineers have put in has produced a sheaf of patents which may allow CBS to collect up to one dollar royalty on every color receiver made, and 50 cents on color converters. There would be advantages on the transmitting side also.

As we pointed out last month, the FCC has been convinced for some time that color television must come, and that it will ultimately oust the black-and-white system. But while they waited for engineers to solve the technical problems, the public were busy buying up existing sets to the tune of 8,000,000-odd, representing a two-billion dollar investment. About the same amount had been sunk by the broadcasting interests.

Looking ahead, the FCC could see even these figures as only a small fraction of the ultimate investment—about one-tenth, for example, of the total number of receivers which the public would ultimately require. If it did not act immediately, the Commission could see not ten but twenty, thirty or fifty million receivers rendered obsolete by the inevitable introduction of color. They duly made up their minds by a majority decision.

The CBS system won out because their engineers were able to demonstrate pictures which the experts considered good enough to introduce commercially. A New York Press representative said recently of the demonstrations:

PICTURE QUALITY

"That the pictures are extremely good, and far superior to black-and-white cannot be denied; they are! This rather important point has been rather seriously overlooked in the general controversy to date."

As for the RCA system, the Commission decreed that it was inferior in quality and not easily operated by the average layman. It also expressed doubt that certain technical difficulties could be overcome.

By inference, at least, many of the efforts made by the anti-CBS interests were written off as delaying tactics, designed to make the public buy black-and-white receivers first, then color receivers at a later date. This, naturally, has been stoutly denied.

The major manufacturers are contending by way of analogy that, if you want an improved railroad, you don't tear up the tracks and render the present rolling stock useless. The only real solution is to evolve designs which fit the current standards.

They maintain that the FCC has virtually delayed the introduction of color by introducing it on an impractical basis. With no immediate black-and-white audience, the color service must grow from nothing in competition with existing high-class shows.

COMPATIBILITY

The compatibility question is so important, they maintain, that work will still go on with compatible all-electronic color. Inevitably it will reach a stage where it will command attention and precipitate a second upheaval in the industry.

Though color is generally conceded to be desirable, and the CBS pictures are admitted as good, the system is branded "technically obsolete" before even it is introduced.

Says the New York Times: "The overwhelming preponderance of engineers and set-manufacturers were against the CBS system on both technical and economic grounds."

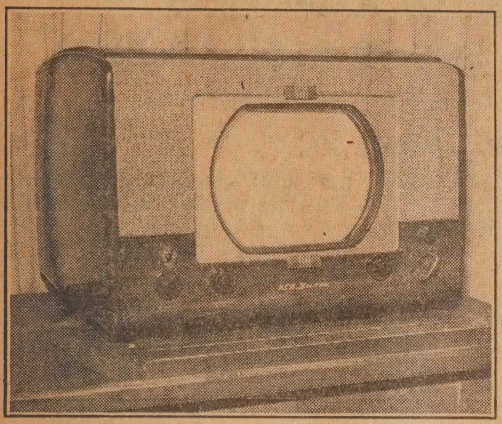
The FCC's ideas about converters and adaptors are condemned as unrealistic because the public, having paid substantial prices for the extra gadgets, are still left with a clumsy combination which cannot be compared with a completely engineered and up-to-date model.

POOR DETAIL

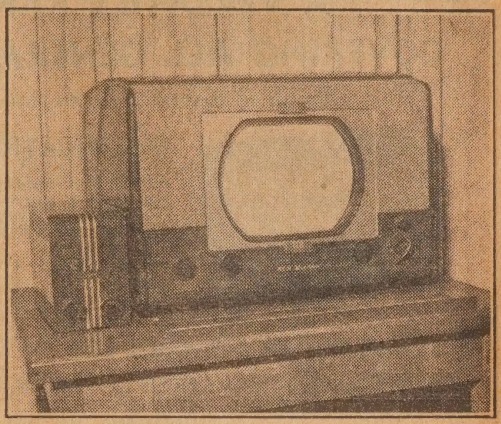
And finally, whereas both color and black-and-white pictures have equal definition by the compatible RCA system, the detail in a black-and-white version of the CBS programme is extremely poor, owing to the coarse line structure.

The US public, which must ultimately pay for all this, has been thoroughly bewildered by the sudden turn

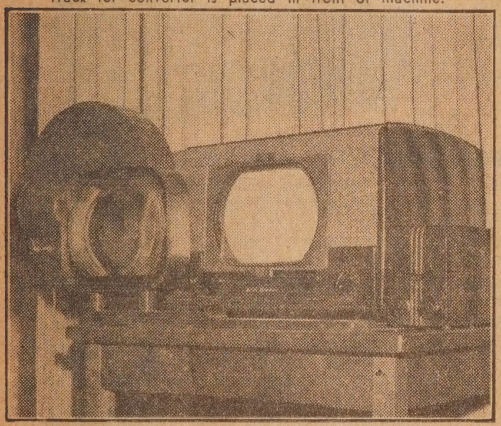
CBS COLOR TELEVISION IN PRACTICE



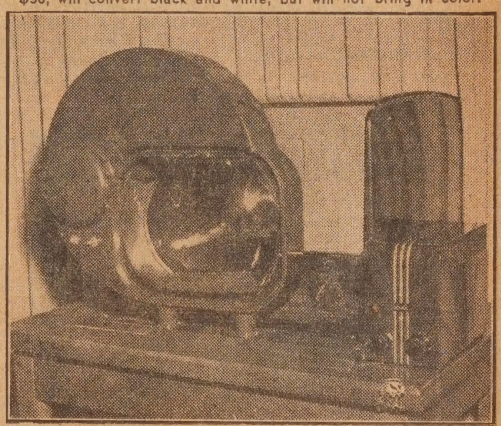
Standard 12½ inch receiver for black and white telecasts. Track for converter is placed in front of machine.



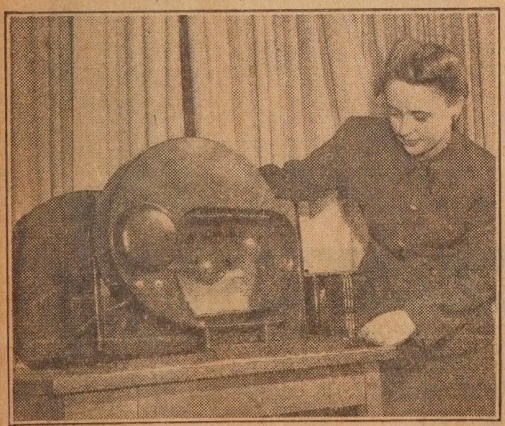
Receiver with adapter box. Adapter, costng $25 to $50, will convert black and white, but will not bring in color.



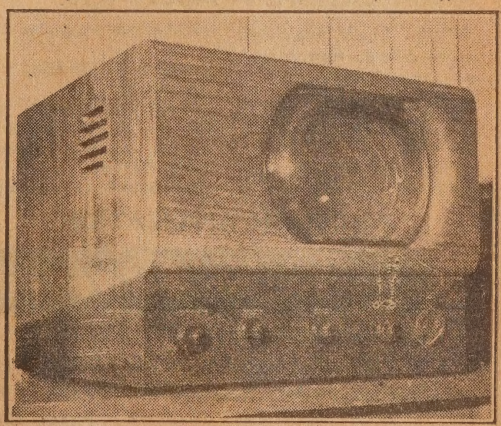
Receiver with converter on track, but pushed aside. these attachments permit reception of color or black and white.



Everything in position for color telecast. Cost of converters ranges from $15 to $100. Model is one of expensive type.



Miss Barbara Keating, of the Columbia Broadcasting System staff, demonstrates how to operate a converted model.



A special-built C.B.S. color receiver with box housing all the attachments. Cost of this set will be beyond the $200 range.

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Details of Special Type Amplifiers, Larger Power etc., on requests.

SPECIFICATIONS — MODEL X4.

INPUTS, high impedance, gramo, .5 meg., microphone .1 meg.

SENSITIVITY, gramo .25 volt, microphone .002 volt.

POWER OUTPUT, 4 watts. Noise level, -45 db.

DISTORTION, maximum 5% at full output.

OPERATING VOLTAGE, AC 240 volts.

OUTPUT IMPEDANCE, 600 ohms.

VALVES, 2/6AU6, 1/6AQ5, 1/6X4.

DIMENSIONS 10½" x 7" x 4⅜".

SPECIFICATIONS — MODEL X15

INPUTS, high impedance, gramo .5 meg., microphone .1 meg. radio .5 meg.

SENSITIVITY, gramo .25 volt, microphone .002 volt, radio .25 volt.

POWER OUTPUT, 15 watts. Noise level —50 db.

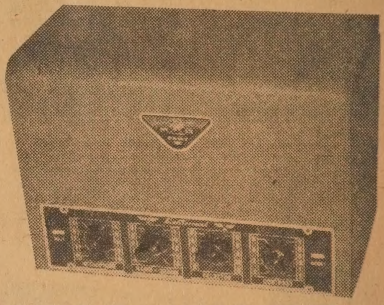
DISTORTION, maximum 5% at full output.

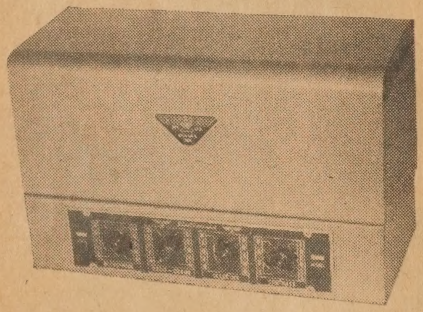
OPERATING VOLTAGE, AC 220, 240, 260 volts.

OUTPUT IMPEDANCE, 600, 300, 150, 75, 37.5, 18.75 ohms.

VALVES, 2/6AU6, 1/6SN7GT, 2/6V6GT, 1/5V4G.

DIMENSIONS—13¼" x 9½" x 8¼".





SPECIFICATIONS — MODEL XV25.

INPUTS, high impedance, gramo, .5 meg., microphone .1 meg.

SENSITIVITY, gramo, .25 volt, microphone .002 volt.

POWER OUTPUT, 25 watts noise level —46 db.

DISTORTION, maximum 5% at full output.

OPERATING VOLTAGE, battery 12 volts or AC 240 volts.

OUTPUT IMPEDANCE, 600, 300, 150, 75, 37.5, 18.75 ohms.

VALVES, 2/6AU6, 1/6SN7GT, 2/807, 2/6X5GT.

DIMENSIONS—16" x 10" x 8¼"

NOTE: This amplifier is designed for use from either battery or A.C. mains. Changeover for either operation is made by simply changing connecting cables supplied with amplifier.

SPECIFICATIONS — MODEL X30.

INPUTS, high impedance, gramo .5 meg., microphone .1 meg., radio .5 meg

SENSITIVITY, gramo .25 volt, microphone .002 volt, radio .25 volt.

POWER OUTPUT 30 watts noise level —50 db.

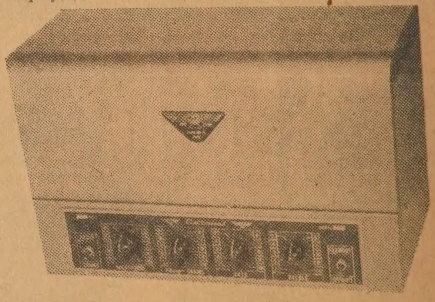
DISTORTION, maximum 5% at full output.

OPERATING VOLTAGE, AC 220, 240, 260 volts.

OUTPUT IMPEDANCE, 600, 300, 150, 75, 37.5, 18.75 ohms.

VALVES, 2/6AU6, 1/6SN7GT, 2/807, 1/5V4G.

DIMENSIONS—16" x 10" x 8¼"



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of events. The RCA system looked so attractive, that no one was overmuch concerned by its possible introduction. The stations could change over to color at will, and there would never be any doubt about having an audience, even if it only had monochrome vision to start with.

There was also talk of an RCA color adaptor for about 175 dollars, which would fit any set, although, in actual fact, this had not progressed beyond the circuit stage.

Though CBS pictures had been creating a favorable impression wherever shown, the ultimate decision in their favor rocked the industry from the broadcasting interests down. It rocked the public, too, and caused them to ask awkward questions about current models and obsolescence. The huge production programmes of the major manufacturers looked like being left suddenly high and dry.

CBS NOT COMMERCIAL

In the face of such opposition, CBS has a lot of convincing to do before it can get anywhere at all with its color programme. Being purely a broadcasting concern, it has no immediate manufacturing interests, and any equipment to be used for the color programmes must necessarily come from the very manufacturers who are now so bitterly opposing the move. Should CBS efforts be blocked by their attitude, the company has threatened to sponsor a 50-million dollar concern to make the sets.

CBS engineers have demonstrated that adaptors can be used with present receivers and a recent demonstration was centred, ironically enough, around a standard RCA Victor receiver.

It was a typical table model, giving nominally a 12½-inch picture from the existing black and white stations including those, of course, in the Columbia network. When tuned to a CBS color transmission, the receiver merely produced a meaningless blur on the screen, owing to the discrepancy in line and frame standards.

CONVERTERS

To operate the receiver sweep circuits at the appropriate frequencies, the CBS engineers then attached an adaptor box which could allegedly sell for about 35 dollars. With this in operation, the receiver produced a black and white version of the color programme being broadcast.

To obtain the color effect a converter then had to be added, which interposed a whirling disc and a lens system between the screen and the viewer. This would push the cost of total conversion up to a nominal 100 dollars. Critics regard this as an optimistic figure and brand the ultimate result as clumsy.

A complete color receiver, engineered from start to finish, could be made to look much more attractive, but, unless it contained special circuitry and means to render the scanning disc ineffective, it would not receive the existing monochrome transmissions.

The urge to buy such a receiver must initially be very small, because the programmes would have to sell themselves largely on color alone. The CBS, like the other major networks, has its hands full in balancing the budget even now using the best hours and the best-paying sponsors for black and white. Color programmes look like having to be sandwiched in at off periods and using unsponsored material.

Apart from its upsetting effect on the industry, opposition to the CBS system centres mainly around the present necessity for whirling discs in front of the picture tube.

OPERATION

The general principle, as illustrated, is not difficult to follow. A more or less standard monochrome camera views the scene through a color wheel carrying red, blue and green filters. The speed of the wheel and the rate of scan is so interlocked that the camera "sees" the scene for one complete frame through the red filter, then for one frame through the blue filter, and finally one through the green filter.

The camera tube simply produces impulses corresponding to the light and shade, as received through the respective filters. The signal transmitted from the stations thus contains all the information about the red frame, then complete information about the blue frame, and finally the information about the green frame.

At the receiver, the signals are ultimately supplied to the picture tube, which produces monochrome light and shade patterns. If the successive monochrome patterns are viewed directly, they merge to produce a black and white picture having shade and tone proportional to the color.

Viewed through a synchronised disc, however, the bright portion of the "red" frame are seen as a bright red image, while portions of the picture containing little or no red receive no red illumination. They may, however, come up as greens or blues and the complete picture is thus built up in color.

LIMITATIONS

The obvious objection to a disc is that it limits both the viewing angle and the size of the picture. From a practical viewpoint, the maximum diameter of the disc is about 25in, which limits the picture to less

(Continued on Page 103)

HOW THE VARIOUS TELEVISION SYSTEMS OPERATE

BLACK-AND-WHITE TRANSMISSION

CAMERA — EACH SYMBOL REPRESENTS TEN SCANNINGS BY CAMERA — RECEIVER

The figure of the clown is scanned by the camera tube. In black-and-white there are sixty scannings per second which are sent out on the air in the form of a sequence of black-and-white impulses. At the receiver these impulses recreate the original image in the studio and the scannings are projected directly on the screen of the black-and-white set in the home.

COLOR AS TRANSMITTED BY C.B.S.

CAMERA WITH ROTATING DISC — EACH SYMBOL REPRESENTS TEN SCANNINGS. SHADINGS INDICATE THE THREE COLORS — RECEIVER WITH ROTATING DISC

The figure of the clown is scanned by the camera. The image passes through a rotating disc containing red, blue and green filters. There are 144 scannings per second, with each individual color scanning being sent out in sequence. At the receiver these scannings pass through a second filter disc, synchronized with the first, which gives the picture in three colors.

COLOR AS TRANSMITTED BY R.C.A.

CAMERA WITH SEPARATE TUBES — EACH SYMBOL REPRESENTS TEN SCANNINGS BY CAMERA — RECEIVER WITH PHOSPHOR TUBE FACE

The figure of the clown is scanned by the camera. There is a separate tube for each color. There are sixty scannings per second, each scanning containing its own components of red, blue and green. At the receiver these scannings activate small phosphors of red, blue and green on the face of the tube. When viewed as a whole the tube gives the complete color picture.

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Model 509 is suitable for Single Motors. Dial fits on front of Cabinet, Lid being lifted only for record playing.

Model 509A is suitable for Record Changers.

Model 510 is a Combinette type Cabinet large enough to take a 5 Valve D/W Set with a Single Motor.

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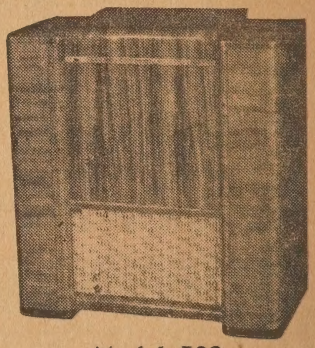

Model 509

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LOW FREQUENCY SIGNALS ROUND THE WORLD

Very low frequency radio signals travelling completely around the world have now been detected by Jack N. Brown of the National Standards Bureau. The signals, transmitted from the Naval Radio Station NSS at Annapolis, Md., on a frequency of 18 kilocycles with a power of 350 kilowatts, were received at the National Bureau of Standards radio propagation field station at Sterling, Va., about 50 miles away.

NORMAL delay time for a round-the-world signal was more than a tenth of a second, and maximum signal intensity was observed at sunset.

The round-the-world signals were received, with the aid of a large loop antenna 150 feet high, on a tuned-radio-frequency receiver.

A dual-beam oscilloscope was connected ahead of the detector stage in the receiver so that the actual unrectified r-f envelope was displayed on the 5-inch screen along with an 18-kilocycle reference voltage. The delay time of the round-the-world signals was measured by making a moving film record of the oscilloscope screen.

The test signal transmitted from NSS consisted of a series of dots, each dot followed by a quiet period equal in duration to five dots. The test tape was transmitted at normal sending speeds, so that the pulse length of each dot was about 40 milliseconds with a repetition rate of four pulses a second.

WINTER TESTS

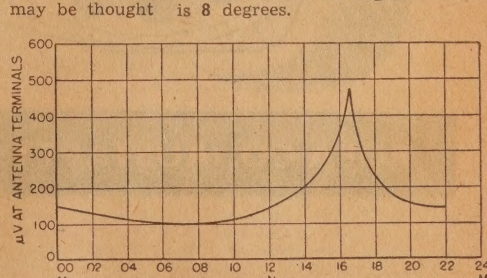
During the winter months when these tests were conducted, the delayed signal was visible throughout the entire day. Observations of field intensity over several 24-hour periods disclosed the striking sunset maximum. A sharp peak in signal strength at 4.30 pm corresponded to optical sunset at the place of transmission and reception. It is an observed fact that low-frequency signals are severely attenuated when their path crosses a sunset zone. Any round-the-world signal must cross a sunset zone except during that portion of the day when the sunset zone is at the transmitter-receiver location. This explains the relatively greater strength of the signals at sunset in the transmitter-receiver location.

Delay times were measured on two different occasions under widely differing ionosphere conditions. Measurements were made first during a severe ionosphere storm, and a second set of measurements were made on a normal day. The average delay time during the storm was 0.1365 equals 0.0005 second, but on a normal day the average was 0.1375 equals 0.0005 second.

The shorter delay time during a storm may be explained by the slightly lower effective height of the reflecting layer of the ionosphere under the influence of corpuscular bombardment from the sun. In any case the average values indicate a shorter propagation path for low-frequency signals during an ionosphere storm.

The transmission of radio waves over long distances may be thought of either as the propagation of a "guided wave" between the concentric spherical surfaces formed by the earth and the ionosphere, or as successive multiple reflections from the earth and the ionosphere.

Within the limits of ray approximation, both pictures yield the same results. For the delay time on a normal day (0.13.73 sec) the number of hops corresponding to an ionosphere height of 65 kilometres is 55 for one trip around the earth. The length of each hop is thus 728 kilometres and the angle of take-off is 8 degrees.



The received intensity of low-frequency round-the-world radio signals shows a striking diurnal variation with a maximum at sunset.

A NEW GEAR SHIFT FOR BICYCLE

A VARIABLE gear on the ordinary push-bike has ceased years ago to be a novelty. It is now the pride of the juvenile heart, and has helped many an older person over steep grades which otherwise might have been climbed on foot.

An elaborate three speed gear box for bicycles has been produced by the New Departure division of General Motors in America. Although it isn't available in Australia, and apparently operates only with a bicycle fitted with a brake of similar make, it certainly looks like luxury cycling, and can be installed in 20 minutes.

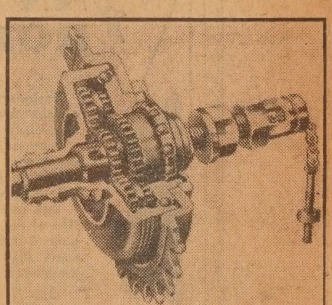
The unit consists of a sprocket and gear assembly, as shown in the cutaway below, that fits into the rear-wheel hub in place of the original sprocket.

In low gear, hub and sprocket are locked, providing a direct drive that is 25 per cent lower than normal, for easier hill climbing.

In second, the hub turns slightly faster than the sprocket, providing a normal riding gear. In high, the hub turns still faster, providing a 33 per cent "overdrive" for speed on slight downgrades.

Shifting is controlled by a cable, connected to a lever on the handle bars, that moves a sliding clutch gear back and forth inside to engage the desired set of gears. Normal braking and coasting are possible in each gear, and gears may be shifted at any time without clashing.

The conversion unit will sell for 14.50 dollars.



LEARNING LESSONS FROM LIGHT

It was Sir Isaac Newton who, some 300 years ago, first showed that ordinary sunlight consisted of a mixture of light of different colors—red, orange, yellow, green, blue, indigo and violet—which could be separated from each other by passing a light ray through a glass prism. Since that first classical experiment, the analysis of light from different sources has grown from a scientific novelty to a distinct and important branch of modern science known as spectroscopy.

by Trevor Williams

BY the analysis of light, often by means of extremely complicated and sensitive apparatus, the modern scientist can obtain an almost incredible amount of exact information about the nature of the source from which it came.

Practically the first developments in this direction were in astronomy. Virtually the only connection we have with the sun, moon, planets and stars is the light which shines from them and after a lapse sometimes of seconds, sometimes of many centuries —falls upon the earth and upon the objectives of scientific instruments.

Yet from this tenuous thread of light, perhaps too weak to be detected at all by the unaided eye, we can learn a very great deal about the heavenly bodies. We can discover, for example, what they are made of, how far away they are, how hot they are, with what speed they are moving towards or away from the earth, and how quickly they are spinning round in space.

From this analysis of huge and almost infinitely remote bodies—many of them utterly dwarfing even the sun in size — spectroscopists have worked their way to the opposite extreme and in recent years have developed not merely ways of analysing the contents of individual cells of living bodies but even of detecting exactly where different substances are located within the cells.

At a recent meeting of the Faraday Society, appropriately enough held at Cambridge, England, where Sir Isaac Newton's first experiment in spectroscopy was carried out, spectroscopic experts from all over the world came together to discuss recent developments with their United Kingdom colleagues, who have taken a leading part in this fascinating new field of research.

A NEW DEVELOPMENT

One of the most interesting of these new developments in microscopy can best be described by analogy with a similar problem on an everyday scale. Suppose we direct the objective of a spectroscope towards the gaily striped canvas of a circus tent and move it slowly so that it successively receives the light from the different stripes.

From the first stripe, perhaps, the spectroscope will show that nearly all the light is red; more detailed analysis of the light, however, can provide much more interesting information because it can tell us precisely which of all the different red dyes was used to color the canvas. Similarly, if the next stripe is yellow, careful spectroscopic analysis of the light coming from it can show what yellow dye was used, and so on for all the other stripes. The stripes on such a tent would be several inches wide; the modern spectroscopist, however, is prepared to carry out the same process on a single cell much less than one-thousandth of an inch in diameter. By using an extremely fine slit on a specially designed spectroscope fitted to his microscope, he can bring into view successive "stripes" of the cell, and, by analysing the light from them, can identify many of the substances present.

Such analyses are not made only with the light detected by the human eye. On one side of the region of visible light is the invisible region of ultra-violet radiation, detectable by means of photographic plates. On the other, is the infra-red radiation, some of which can be detected protographically and some by its heating effect.

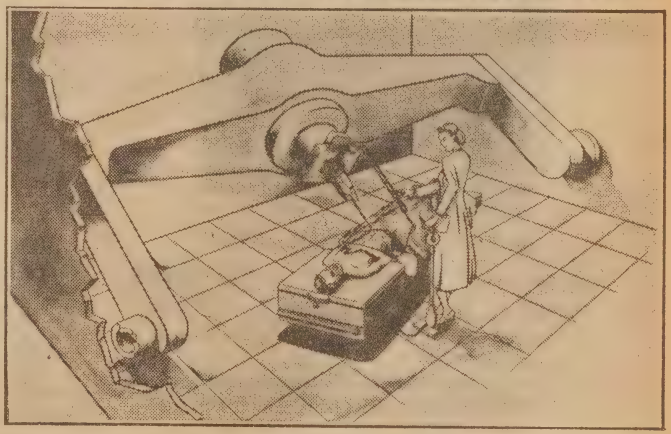
Many substances which do not affect ordinary visible light produce characteristic changes in ultra-violet or infra-red radiation passing through them and these changes serve to identify them. The use of ultra-violet light, too, has a very definite advantage, for it allows twice the magnification possible with visible light.

MIRRORS REPLACE GLASS

Venturing into these regions of invisible light has, however, brought many fresh difficulties. Greatest of these is that glass, normal material for the lenses of microscopes, is quite opaque to these invisible rays. To

(Continued on Page 13)

NEW SUPER X-RAY MACHINE FOR CANCER



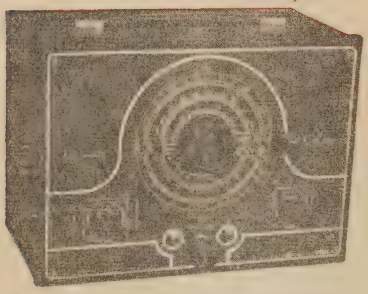
Resources under the National Health Service for the treatment of CANCER and other diseases, will be considerably strengthened when five super-voltage X-ray therapy machines of new design, become available for use in the United Kingdom. The machines, of all British design, craftsmanship and materials will be capable of producing the effect of four million volt X-rays — they are known as LINEAR ACCELERATORS. One will be centred in London, another in Scotland and the other three in the Provinces. The new machine is small and mobile (about 5ft long) and remarkably compact for a machine of this high voltage. This will enable the machine to be swung about inside the hospital treatment room. Overall cost of the five machines including installation will probably be between £200,000 and £225,000. This sketch is the Metropolitan-Vickers conception of what one of the LINEAR ACCELERATORS will look like — this firm is making three of the super X-ray machines.

TEST EQUIPMENT FOR SPEED AND ACCURACY

University

MODEL MVA/2 MULTIMETER

Undoubtedly the most popular Multimeter in Australia. A reliable first-class Instrument designed for either use on the bench or as a portable Instrument in the field. It has a wide range of A.C. and D.C. volts up to 1000 volts, also a wide range of output from —10 db to plus 45 db. D.C. current can be read from 1 Milliampere in several ranges up to 10 Amperes D.C. It its self-contained in its resistance readings which are four separate ranges up to a total of 1 megohm. Values as low as .25 of an ohm can be measured on the low Scale.
Firmly and sturdily built yet pleasing in appearance, the MVA/2 fills a long-felt want. A.C. and D.C. current ranges can be extended and a leatherette covered Carrying Case is available separately if so desired.



MODEL XOA OSCILLATOR

This fine Oscillator is available either as an A.C. operated Instrument or as a Battery operated Instrument. It has a comprehensive frequency coverage from 160 Kilocycles to 32 Megocycles in five bands. It can be used unmodulated or modulated. The modulation is 30% at 400 cycles. The Dial and Output Control are calibrated and the Instrument is entirely self-contained.

WRITE FOR FURTHER DETAILS

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This handy little Instrument is designed to increase the alternating current range of any suitable Multimeters such as Model MVA/2 above. It allows you to measure A.C readings as follows:—
2½, 5, 10, 25, 50, 100, 250 and 500 mA.
1, 2½, 5 and 10 Amperes. A.C.

University

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MEASURING NEW SPEED OF LIGHT

An experiment recently completed at the National Physical Laboratory has shown inaccuracy in the normally accepted figure for the speed of light. The difference is not great — only eleven miles per second. It is however, far from being a matter solely of academic interest, for the speed of light is used for many of the fundamental calculations in atomic theory. The more accurate figure is of immediate practical value in radio and radar.

THE speed of light is, in Einstein's theory of relativity, the highest speed at which anything can travel. It is therefore an important physical constant and its measurement has provided a problem for many scientists for many years. A great deal of time and money have been spent since Romer first obtained a value of 192,000 miles per second from astronomical observations in 1676. The first direct experimental measurement was made by Fizeau in 1849. A beam of light was focused on the rim of a toothed wheel and after passing through a tooth it travelled a distance of four miles and was reflected back to the wheel. If on its return the light fell upon one of the teeth it could no longer be seen from behind the wheel. The wheel was therefore speeded up until the light disappeared, and the time of travel was calculated from the rapidity with which the wheel was turning. In more recent times, in 1935, Michelson in the USA made a famous experiment in which a beam of light travelled in a metal tube a mile long; the tube could be evacuated in order to remove the small effect of the atmosphere on the speed. The final value he obtained was 186,271 miles per second. This figure was confirmed in other experiments and has been accepted ever since.

NEW FIGURE

When Dr. L. Essen, of the National Physical Laboratory, announced in 1947 that the figure should be 186,282 miles per second the result was received with some scepticism; he has now confirmed the result using more refined apparatus, and results recently obtained in Sweden and in the USA agree with this value to within one kilometre a second.

Dr. Essen is in the electricity division of the NPL, where his work is concerned with the propagation of radio waves. Radio waves differ from light waves only in their wavelength and it is generally assumed that they travel at the same speed. During the war Essen was frequently asked what was the correct value of the speed of light and he began to suspect that, although they had been carried out on such an impressive scale, the experiments were perhaps not as accurate as was generally believed. He thought that the NPL might do better by using radio waves and started work on the problem as soon as possible after the war.

The method is similar in principle to Michelson's, but whereas he used a tube a mile long Essen's tube is only seven inches long. A radio wave was sent down this metal tube and reflected backwards and forwards between the two ends. When the time of travel between the ends equals the time interval between successive waves they build up to produce an electrical resonance

from
D.S.I.R.
London

which can be detected with very high precision.

In this experiment the time of travel is about one-ten-thousand-millionth of a second (1-10,000,000,000), or in other words the waves follow one another at a frequency of 10 thousand million per second, and it was necessary to measure this frequency with an accuracy better than one part in a million. This is just the kind of problem that Essen was working on during the war and the equipment that was built then was ideally suited to this velocity experiment. The construction of the tube called for very skilled workmanship, and its dimensions had to be accurate to one-hundred-thousandth of an inch. The Metrology Workshop, where the tube was made, achieved a result ten times better than they would previously admit was possible, and the gauge section of the metrology section had to devise new techniques to give the required accuracy of measurement.

The speed of light was not wanted accurately for any practical purpose until the advent of radar in World War II. In radar the distance to an object is calculated from the time taken by a pulse of radio waves to travel there and back, the speed of the waves being the same as that of light. The new figure will therefore enable radar to be used more accurately. This will be particularly valuable for aerial survey work where the shape of the ground is plotted by means of radar.

The speed of light also is used in calculating a great number of physical constants. The most significant changes will probably be in astronomy, in atomic research, and in the field of radio.

The changes are small and are not at present of much importance, but a hundred years ago the extreme accuracy of modern measurement would have been thought waste of time. Possibly within living memory one sixty-fourth of an inch was a sufficiently fine degree of measurement; now in engineering works accuracy to a ten-thousandth of an inch is constantly required, while the National Physical Laboratory, in its work on the standards of length, has to measure to a millionth of an inch. So, in the not too distant future, this change in the figure for the velocity of light may prove of great importance.

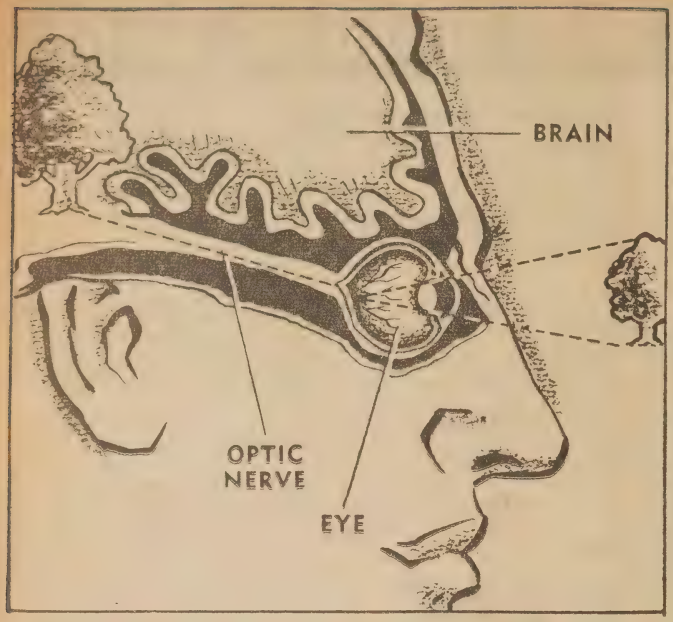
LEARNING LESSONS FROM LIGHT

(Continued from Page 11)

overcome this, quite a new type of microscope has been evolved, notably by research workers at the University of Bristol, in the West of England.

But what, it may be asked, is the compelling motive for the development of these elaborate and costly instruments just to find out how different substances are distributed within living cells? The reason is far more than scientific curiosity; the results to be obtained are of immense practical importance in medicine.

The cell is the unit of life and every living animal and plant is made up of many millions of separate cells, whose combined activities make up the life of the organism. In turn, the life of each cell is an expression of the many complicated chemical changes which constantly take place inside it. In the ultimate analysis, illness is a disturbance of these vital chemical changes and knowledge of the nature of these disturbances is vital to a clear understanding of the nature of disease.



How the eye works. Light reflected from the object falls upon the retina. The image sets up a number of impulses which the nerves carry to the brain. Here a tree image is built up. Thus sight is really a process of nerve and brain activity.

THE MIRACLE OF SIGHT

The human body contains many biological marvels, but few more fascinating than the eye, which is, in fact, a perfect camera. But whereas a picture to a camera is just a picture, to the eye it is a nervous and emotional experience conveyed to the "operator's room"—the brain.

by Calvin Walters

THE design of all systems of communication is closely bound up with the study of the organs of sense of the human body which is intended to respond to the applied stimulus.

The most common example of this is the design of radio receivers and transmitters, where musical notes and speech (not to mention almost every kind of raucous noise capable of being manufactured) are reproduced by means of vibrating diaphragms, such as microphones, loudspeakers and earphones.

THE EAR

In radio telephone communication and broadcasting close study must be made of the functions and capacity of the human ear. Upon this knowledge is based the design of almost all of the equipment used in transmission and reception.

The amplifying equipment with its tubes, condensers, resistances and wires, must be so designed that all the musical and speech frequencies must be faithfully transmitted to the receiving station. The microphones and landlines, the pickups and records must be so designed that the least possible deviation from the original is maintained.

That this is not always accomplished is well known to radio fans and any member of the discriminating public. Many are the radio sets which rend the air with sounds which make a Japanese orchestra sound like the Boston Symphony Orchestra by comparison.

One has only to tune to the amateur band on a shortwave set to find just what should NOT be done in the way of broadcasting. (This is going to cause our editor to get on his hind legs but confidentially, I have heard even him remark about the rotten microphone VK2 . . . was using and how the modulation was crook, &c.)

However, to throw some oil on troubled waters in advance, so to speak, most of our present knowledge was gained by the experiments of amateurs, and admittedly some amateurs give us a good idea of what SHOULD be done. With our knowledge of the human ear it has been possible to transmit a range of frequencies which is tolerably near to the original and the greater the economic capacity of the designer the nearer to realism it is possible to get. (Judging by some of the results I have heard some designers must be flat broke.)

"SMELLIES"

It is noteworthy that about the only organ of sense so far not invaded by design engineers is the nose. No one has so far found a means of transmitting or amplifying smells. This is just as well. Imagine a radio murder serial broadcast from the local abattoirs or a boiling-down works at Botany, NSW. A band recital from a park on the banks of the Parramatta River in Sydney or the Yarra in Melbourne would lose some of its appeal if the broadcast was made at low tide accompanied by the usual notorious odors. I have never been in any other State, but in case I seem to be particularising, I include any suitable river in South Australia, Western Australia, Queensland and Tasmania.

Of course, there would be uses for the broadcasting of smells. It has vast possibilities in warfare by broadcasting overpowering stenches to the enemy. The one with the worst smell wins. It would be possible to jam a bad smell from Moscow with a worse one from Chicago, or vice versa according to one's politics.

HUMAN EYE

We seem to be wandering a bit. What I am trying to work up to is the fact that the advent of television has made a close study of the human eye absolutely imperative if good results are to be obtained. (Mind you I am not claiming that it was I who found this out. It has been known for a long time.)

It is a well known fact that the human eye sees things. Even a baby knows that. But what a baby doesn't

know and what a lot of grown-ups refuse to recognise is that the eye has a definite effect on our emotions in different ways in different individuals. So that a silly looking "hat" perched on top of a woman's head looks "goodo" to the wearer.

This is ideal for the fashion experts but really even this has not much to do with our subject.

The human eye is a most remarkable instrument. It consists, for our purposes, of a lens and a retina. There are other items such as the cornea, iris, vitreous humor (has nothing to do with being funny) and the optic nerve. We are most concerned with the lens and retina but may make passing reference to the others.

The lens at the front of the eye collects the light waves and concentrates them on the retina at the back of the eyeball. It is like a camera with a lens in front and a sensitive film at the back.

The retina is a most complicated piece of apparatus consisting of a membrane covering the rear two-thirds of the eyeball.

It can be compared with a nervous net and consists of about 18-million light sensitive elements or cells called rods and cones. The centre of the retina consists of nothing but cones and the outside of nothing but rods. In between there is a mixture of both.

RODS AND CONES

The cones are more sensitive to bright light and the rods more sensitive to dim light. It is only the cones which enable us to distinguish color, which explains why it is difficult to pick out colors in semi-darkness. It also follows that in a dim light we see more out of the corners of our eyes for then the light falls on the rods on the outer edge of the retina.

All these cells are connected by nerve fibres which run down the back of the eyeball and converge into a thick bundle, which is called the optic nerve. This connects to the brain. At the point where the optic nerve leaves the eyeball there are no sensitive cells so there is no vision. There is a blind spot, therefore, in each eye, but this is not noticed because what one eye misses the other sees.

If you want to observe these blind spots turn to the diagram of the dot and cross on this page. Close the left eye and look steadily at the dot with the right eye while the page is held about six inches from the eyes. Both the dot and cross are visible.

DISAPPEARING DOT

Gradually increase the distance between the page and the eye, still looking steadily at the dot with the right eye. It will be found that at one point the cross suddenly disappears as its image falls upon the blind spot and reappears on removing the page still further away. Do the same with the right eye closed, looking steadily at the cross with the left.

The site of the most acute vision is exactly in the middle of the retina where the light is focused by the lens. This point is called the macula. Although we have a wide field of vision and can dimly see things at the side while looking straight ahead we can only see distinctly those things directly in front of the eye. In other words, the object immediately in front of the eye is in focus while the rest are out of focus.

According to Donald G. Fink in his book, Principles of Television Engineering, the eye has eight primary abilities, as follows:—

The ability (1) to distinguish between light and darkness. (2) To distinguish between colors. (3) To transmit sensation of both color and brightness to the optic nerve some time after the stimulus is removed, the so-called "persistence of vision." (4) To perceive the geometrical arrangement of the various parts of the image through the simultaneous excitation of many rods and cones.

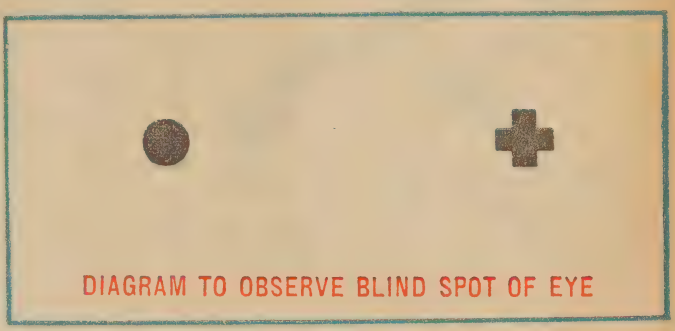
The geometry reveals width and height directly and depth indirectly by perspective. (5) To distinguish motion in an image, as the geometry of the image changes and as a given part of the image illuminates several rods and cones in sequence. (6) To distinguish detail, each small detail being perceived by an individual cone or small groups of them. (7) To distinguish far objects from near by means of the focusing action of the lens, &c. (8) To infer the relative distance and positions of several objects by perception of the effects of the angle between the lines of sight from the eyes to the objects in question. This is the so-called "stereoscopic perspective and is the result of the possession of two eyes."

Fink takes these eight abilities of the eye and creates a definition of the word scene for television purposes as "an illuminated two dimensional area or three dimensional space, the contents of which the eye sees as a distribution of small lighted areas with different degrees of color and brightness. The eye sees these areas in such a way that the two dimensions, width and height, are seen directly, but the dimension of depth is only inferred by perspective." This definition seems rather tedious, but if read carefully it will be seen to contain all the important eight points as enumerated above.

STEREOSCOPICS

A television system cannot achieve all the eight abilities of the eye without employing six complete picture transmission channels at once. By these means a pair of images in each of the three primary colors with the pairs arranged in stereoscope fashion can be transmitted. But as a one picture transmission channel is the recognised limit at present it is not possible to transmit color and a stereoscopic picture.

This eliminates two of the eight eye abilities, leaving six, which are now used to transmit a black-and-white picture in motion. It is a remarkable achievement that a transmission system can so closely approximate the functions of the eye.



There is a blind spot in your eye where the optic nerve enters. Close your left eye, and look steadily at the spot with the right. As you bring the page near your eye, you will see the cross disappear, to reappear again as the page is brought still closer.

The picture on a television screen is made up of what are called "picture elements." These approximate to the small dots which make up any of the pictures in this magazine or any newspaper or book.

They consist of small areas of light and shade. This brings up the matter of what is called "visual acuity," which is the ability of the eye to distinguish details of any observed scene. This ability of the eye is caused by the lens focusing the scene on to the separate rods and cones of the retina. Each cone in the most sensitive portion of the retina is connected to the optic nerve by a separate fibre and thus can register sensation independently of other cones so that each detail of a scene is registered by only one cone or a small group.

It is thus seen that when a picture consists of picture elements these separate elements can be distinguished from each other if they fall on separate cones.

When a picture is viewed close-up a large image is focused on the retina and each picture element falls on one or more separate cones. The details of the picture are then clear.

(Continued on Page 100)

Technical Review

STEREOPHONIC SOUND—FIRST BROADCAST

The first broadcast of stereophony, the system in which sources of sound are restored to their relative positions in space, took place in France on June 19th, 1950. The transmission was made simultaneously by two chains of French broadcasting stations, the Parisian and the Paris-Inter.

TO make use of this transmission two receivers were needed. For some days before it took place, the broadcasting authorities made frequent announcements, urging friends to join forces in small groups so as to receive it under optimum conditions.

To obtain these, it was explained that two receivers should be placed from five to seven feet apart, with the axes of their loudspeakers converging at a very small angle; the listeners should be at the apex of an isosceles triangle with the sides some seven to 10 feet long, the base being a straight line joining the two loudspeakers.

It was also necessary that the receivers should be adjusted to give the same volume of sound and that their reponse should be matched as nearly as possible by means of the tone controls.

DARKENED ROOM

Lastly, it was strongly recommended that listening should be done in a darkened room, or at any rate, with the eyes closed, in order to prevent any conflict between oral and visual impressions. This point was found to be of very great importance.

At 8.50 pm, the programme began with an opening speech by Rene Clair, of French film fame, who had undertaken the task of producing it. After briefly reminding listeners of the conditions required for hearing the transmission properly, he went on to the reproduction of a series of sounds, which showed the acoustic possibilities of the new technique.

The listener's ears could follow a train as it started, gathered speed and crossed from left to right; troops, headed by a band, appeared to march from one side to the other of the room in which he was sitting; the sounds of footsteps going quickly up a spiral staircase could be followed. In each of these examples the ears "pin-pointed" the source of sound readily and very exactly. The impression of movement was strikingly realistic.

Next, listeners, were regaled for more than an hour by the production of an unpublished play of Theophile Gautier's, Une Larme du Diable.

The idea of making a reproduction reconstitute the spatial relations of sources of sound is by no means new. It is well known that, provided it does not come from a point immediately in front of or behind the head, the brain determines the direction from which a sound arrives mainly through its differing intensity at the two ears.

When listening to broadcasts made by ordinary methods we would be quite satisfied if we used only one ear, because all the sounds which reach the microphone are reproduced by the single small surface of the loudspeaker diaphragm.

The problem of stereophony (Greek stereos, solid) has provided material for a vast amount of research work. Clement Ader, who did such fine pioneering work in the field of aviation, made one of the first practical attempts as long ago as 1881, when he used his "theatrophone" for the transmission of operas over telephone lines.

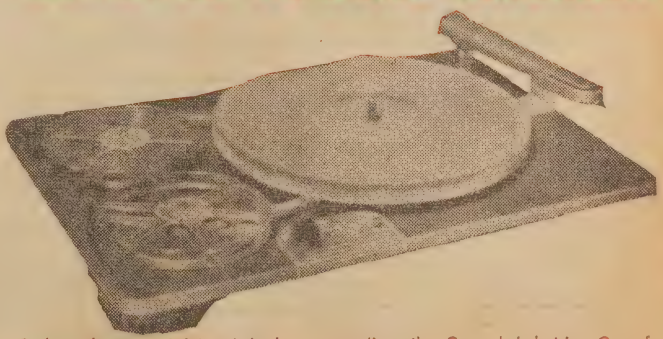
AMERICAN TEST

But one of the most striking experiments was that made by the American Telephone and Telegraph Company on April 27, 1933, when a concert given at Philadelphia was reproduced in a Washington hall by means of a two-channel system. Sounds were picked up by two microphones on the right and left of the orchestra and sent, with suitable amplification, to two loudspeakers similarly placed in the Washington hall.

What may be termed the acoustic perspective was faithfully restored in the reproduction. When the producer walked across the stage,

(Continued on Page 37)

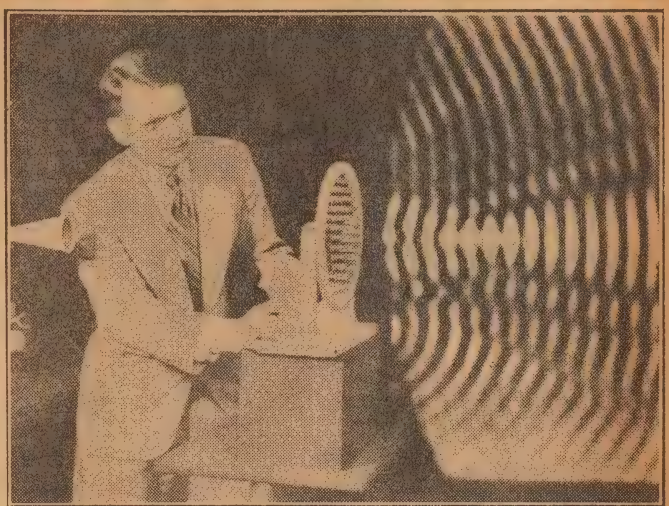
COMBINED TAPE-DISC RECORDER



Backing the general interest in home recording, the General Industries Co. of Elyria, Ohio, have released this combined disc and tape recorder on the American market. Designated as G.I. model 250, it is intended for installation in the more expensive combination receivers. It will record and play back both disc and tape and can be used as a standard 78 rpm record player.

MICROWAVE LENS FOCUSSING SOUND

Hertz was the first to prove that radio waves could be reflected and refracted with lenses like light waves. His discovery was for many years one of the well known but unused facts of radio. It was not until microwaves came into use that the lens idea was applied to bending or beaming radio waves.



Using a microwave lens for sound waves. Waves are propagated from the small horn at the left. The neon tube traces the light pattern during a 10 minute exposure.

THE first of the modern electro-magnetic lenses was patterned on wave-guide principles. It was developed at the Bell Telephone laboratories and described in this magazine, July, 1947. The wave-guide type of lens was highly directive and could focus radio waves in a narrow beam. It had one disadvantage —a given lens was confined to a narrow band of frequencies.

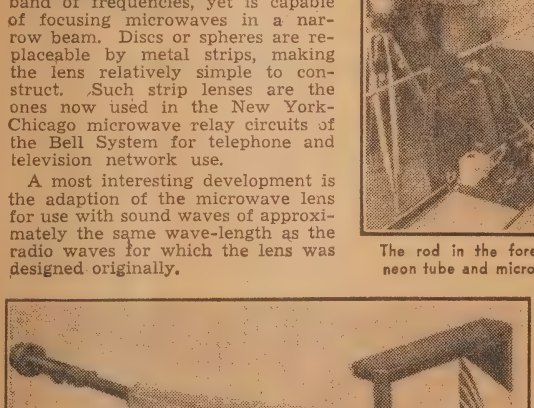
A later lens, also developed by scientists of the Bell Telephone Laboratories, overcame this drawback. It was composed of small spheres or discs of conducting material, and slowed the radio waves down as a lens of glass slows down a ray of light.

WIDE BAND-WIDTH

It can be used over a very wide band of frequencies, yet is capable of focusing microwaves in a narrow beam. Discs or spheres are replaceable by metal strips, making the lens relatively simple to construct. Such strip lenses are the ones now used in the New York-Chicago microwave relay circuits of the Bell System for telephone and television network use.

A most interesting development is the adaption of the microwave lens for use with sound waves of approximately the same wave-length as the radio waves for which the lens was designed originally.

The rod in the foreground carries a neon tube and microphone which trace the pattern.



Slant plate type of lens used where diffusion is desired.

This is an important step in the microwave field as well as in audio, for the lens can not only be used to beam sound waves, but the characteristics of a lens intended for microwave frequencies can be determined with the simpler and cheaper equipment which can be used to produce sound waves rather than the more costly microwave equipment.

A lens of the obstacle type consists of a collection of objects which are small compared to the wave-length of the radiation being focused.

W. E. Kock, who invented the wave-guide lens and the obstacle lens, reasoned that in a glass lens for refracting light, the molecules of glass are so small as to give the impression (even under a microscope) of a perfectly smooth and homogeneous medium.

As the wave-length is increased, the size of the obstacles and their spacing can be increased till, for sound waves in the order of several thousand kilocycles (or microwaves in the centimetre region), they look like the lens shown above.

LENS THEORY

According to the commonly accepted theory of lens action, a lens slows down the waves transmitted through it because of reflections from the small elements that make up the lens. Thus the molecules of glass reflect back part of the light that impinges on them, and the beam which finally emerges from the lens is a resultant of the original wave which entered it and all the small reflections from the molecules of glass.

In an electric lens, the "molecules" should be perfectly conducting to make a perfect lens—in an acoustic or audio lens they should be perfectly rigid.

Although perfection is not often found in the field of physical experi-

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0-3	0-6 mA	0-15	50-2250-100,000 ohms.
0-15	0-30 mA	0-150	x 500-22,500-1 megohm.
0-150	0-150 mA	0-300	x 5000-225,000-10 megohms.
0-300	0-1.5 Amps	0-600	
0-600			x with external battery.

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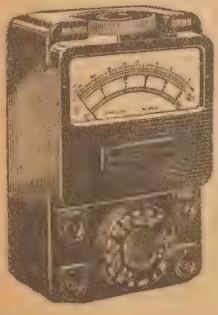
D.C. Volts	A.C. Volts	A.C.-D.C. Current	Decibels	Resistance
0—0.1	0—1	0—50 uA	—30 to —5	1—50—10,000 ohms
0—2.5	0—2.5	0—5 mA	—22 to +3	1000-50,000—10 Megohms
0—10	0—10	0—50 mA	—10 to +15	*10,000—500,000—100 Megohms
0—50	0—50	0—500 mA	+6 to +29	
0—250	0—250	0—5 Amps	+18 to +43	* With external battery.
0—1000	0—1000		+30 to +55	

This is a robust 20,000 ohms per volt 50 range universal multimeter designed for accuracy and stability. Fitted into an attractive case, the meter is provided with instantaneous OVERLOAD PROTECTION. The clear, easy to read scale has a length of 4 inches. An internal buzzer is provided for quick continuity tests. Complete with test leads.

PRICE £19/15/- Plus Sales Tax.



MODEL 120A POCKET MULTIMETER

RANGES 1000 ohms per volt A.C.-D.C.

D.C. Volts	D.C. mA	A.C. Volts	Resistance
0—0.25	0—1	0—10	0.5—20—2000 ohms
0—10	0—10	0—50	50—2000—200,000 ohms
0—50	0—50	0—250	*500—20,000—2 Megohms
0—250	0—500	0—500	*5000—200,000—20 Megohms
0—500		0—1000	
0—1000		0—2500	* With external battery.
0—2500			

This is an accurate pocket size instrument using a robust, sensitive meter movement fitted with instantaneous OVERLOAD PROTECTION and is housed in a high grade moulded case. All resistors used for voltage and current ranges are adjusted to an accuracy of 1%. Supplied complete with test leads.

PRICE £9/17/6 Plus Sales Tax.
DIMENSIONS: 4¼" x 3½" x 2"

Australian Distributors:

JACOBY MITCHELL & CO. PTY. LTD.

MA5475—MA5058

Sales and Showrooms, 277 Clarence Street, Sydney.

Queensland: CHANDLERS PTY. LTD., Cnr. Albert & Charlotte Sts., Brisbane.
Victoria: J. H. MAGRATH & CO., 208 Little Lonsdale St., Melbourne.
NSW: JOHN MARTIN PTY. LTD., 116 Clarence St., Sydney.
SA: GERALD & GOODMAN LTD., 192-196 Rundle St., Adelaide.

Taylor — Best for TEST EQUIPMENT

Manufactured by:—TAYLOR ELECTRICAL INSTRUMENTS LTD., GREAT BRITAIN

ment, the metal of which the lenses are made is a sufficiently good conductor and also mechanically rigid enough to make an efficient lens.

The focus pattern can be seen on the front cover. (A "perfect" photograph would have shown a sharper focus at the point of greatest light intensity.)

The equipment which plotted the field has the simplicity of genius. A neon bulb and a microphone are mounted on the end of a rod, which is attached to a carriage. The rod swings slowly up and down, at the same time backing away from the lens at a rate that makes each swing one-tenth of an inch farther from the lens than the last one.

MICROPHONE

The microphone is connected to the input of an audio amplifier, and the neon bulb to the output. The lamp, therefore, lights brightest in regions of maximum signal. The sound is produced by a standard audio oscillator and is beamed at the lens by a high-frequency horn or transducer.

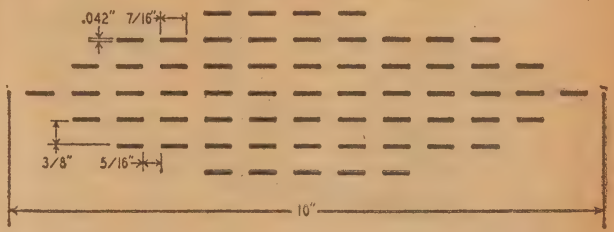
The above explanation is a simplification, as a second signal of the same frequency must be mixed with the wave to produce the interference pattern which gives the standing waves shown in the photograph, but is correct in the fundamentals. A camera takes a time exposure of the flickering neon lamp in complete darkness to make a permanent record of the pattern.

One of the simplest types of lenses is that illustrated on the cover. Originally developed for micro-waves by Dr. Winston E. Kock and later used with sound waves by Kock and F. K. Harvey of the Bell Telephone Laboratories, it consists of a simple array of metal strips.

Aluminium is used in the lens portrayed here, though there is no good reason why copper or any other metal with the necessary requirements of rigidity and conductivity should not be used.

Details and dimensions of the lens are given on page 21. This lens cuts off at around 10,000 cycles (audio waves) or with radio waves at a little longer than three centimetres. Waves of lower frequencies (longer wavelengths) are refracted over a wide band, though the efficiency of the lens is greater for wave-lengths of less than twice the lens diameter.

Metal arrays can be used for diffusing as well as focusing sound waves.



Cross-section of the 10-inch lens. Drawing is 40% actual size. The individual strips of which the lens is made are cut to such lengths that their ends fall on circles which are ten, eight, six and three inches in diameter.

One use is broadening the usually very directive field of high-frequency horns. Although a wide-angle lens of the strip type described above could be used, the slant plate type of lens is preferred. Instead of slowing down the wave by partial reflections, it leads portions of the wave along a longer path than they

The focusing (or rather diffusion) pattern can be changed by varying the shape of the lens. Those portions of the sound wave that are detoured farthest can be compared to those which go through the thickest part of the obstacle lens.

Audio lenses may well have a num- would normally travel, slowing them down by detouring them.

ber of future applications other than those discussed in this article. Meanwhile they can shed a great deal of information on the behavior of micro-wave lenses at frequencies where performance of electronic equipment is not always invariable.

The experimenter may be interested in constructing a lens either for audio or radio waves of three to 10 centimetres and longer wavelengths. The necessary dimensions are given in the figure.

—Radio Electronics.

TURBO-JETS IN PRODUCTION

THE remarkable manner in which the jet principle has built its way into the aircraft industry has been a feature of the last year or two. This applies not only to the pure jet engines used principally for fighter aircraft, but to the turbo-jet, which may prove to be the most practicable application of the jet to less speedy aircraft as found, for instance, in commercial aviation and bomber aircraft.

Not the least of the problems involved in applying the jet is the necessity for using metals capable of withstanding extreme heat for long periods. Both turbines and exhausts are subject to blasts of extremely hot gases when the engine is operating.

The picture printed below shows a bank of stainless steel cones being built for mass produced engines to be fitted to American war planes which use turbo-jet engines. They are built to accuracies up to 1/10,000 inch and will handle temperatures of 1300 degrees from the turbines of J-47 engines.

100-MILLION PHOTOS PER SECOND

DEVICE for making 100-million photographs per sec. has been developed at US Army Aberdeen Proving Ground. The Army is using it to record shock and detonation waves in studying explosives in shaped charges.

The terrific speed is made possible by a framing grid and rotating mirror. The grid is a focal plane shutter consisting of a series of parallel slits through an opaque plate. Slit width determines exposure time, and the ratio of space width to slit width determines number of successive frames.

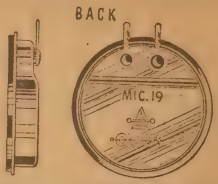
The mirror sweeps a full-size image of the grid across a 4 x 5in film plate. The total distance the image moves to expose the entire film is only one space width.

To obtain a detonation record, a first image is formed on the grid and the image combination moved across the film by the mirror. Resulting picture is viewed through the grid.

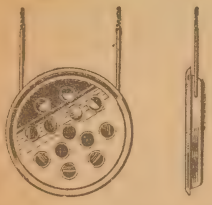
Choose your equipment from this famous range!

ACOS MICROPHONE INSERTS

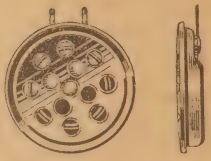
MIC. 3 DIAPHRAGM-ACTUATED crystal microphone, specially designed for the reproduction of speech frequencies. With rising response from 1000 c/s, this microphone has exceptional sensitivity.
Price: £1/8/2.



MIC. 19 SINTERCEL fulfils the requirement for a flat insert with good sensitivity and a frequency response 40/8000 c/s Unaffected by vibration, exceptionally robust construction.
Price: £2/15/0.



MIC. 18 MICROPHONE SPEECH INSERT provides high acoustic qualities with minimum bulk. Where exceptional slimness is required, this Insert is recommended.
Price: £1/16/0.



MIC. 14 STANDARD SPEECH MICROPHONE INSERT with nickel-plate brass case which gives high corrosion resistance, mechanical strength and rigidity.
Price: £1/8/2.

TYPE "A" MICROPHONE. Specially designed for clear production of speech. Ideal for public address; office and factory call systems; amateur and mobile radio transmitters, etc.
Price: £6/17/6.

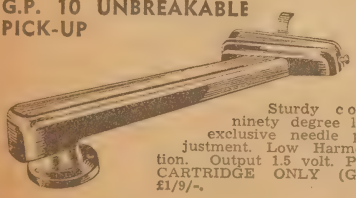
G.P. 20 MICROCELL PICK-UP

The most outstanding pickup on the market! Incorporates the latest advances in pickup design and sets a new high standard in sound reproduction. The Acos MICROCELL has 20 times greater output than comparable magnetic types; needle talk and motor rumble is practically non-existent. Fitted with permanent sapphire stylus and automatic bass-boost which permits fitting to any domestic radio without additional equalisers. Plays Microgroove or ordinary recordings. Available from all Radio Stores. **Price: £5/8/6**
CARTRIDGE ONLY (G.P.19) .. .. **Price: £3/1/6**

Price £5/8/6

ACOS CRYSTAL PICK-UPS

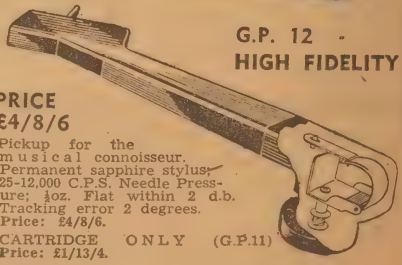
G.P. 10 UNBREAKABLE PICK-UP



PRICE £2/13/6

Sturdy construction; ninety degree lift-back and exclusive needle pressure adjustment. Low Harmonic Distortion. Output 1.5 volt. Price: £2/13/6. CARTRIDGE ONLY (G.P.9) Price: £1/9/-.

G.P. 12 - HIGH FIDELITY



PRICE £4/8/6

Pickup for the musical connoisseur. Permanent sapphire stylus; 25-12,000 C.P.S. Needle Pressure; ½oz. Flat within 2 d.b. Tracking error 2 degrees.
Price: £4/8/6.

CARTRIDGE ONLY (G.P.11)
Price: £1/13/4.

AMPLION (A/sia) Pty. Ltd.

36-40 Parramatta Rd., Camperdown, Sydney. Phone LA2828.

SOLE AUSTRALIAN REPRESENTATIVES

HOW IT WORKS—THE GEIGER TUBE

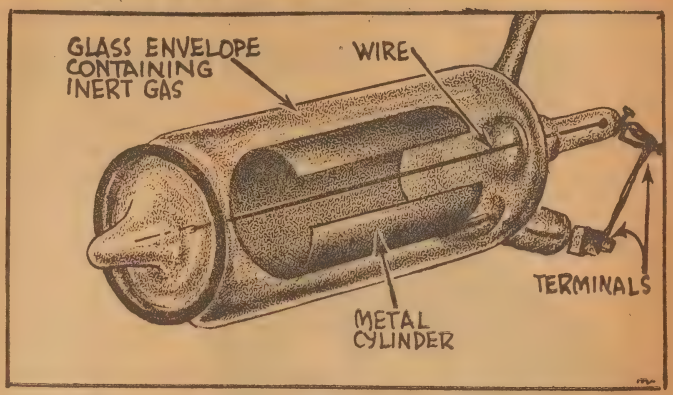
AS materials subjected to atom-bomb attack give off dangerous radio-active particles, Geiger counters would be an essential feature of defence against future attack of this kind. The Geiger counter will reveal when radiation has ceased and an area is "clean."

Charged particles produce an electrical effect when they pass through matter. The Geiger tube, heart of the Geiger counter, is sufficiently sensitive to be affected by the passage of such particles, and the disturbance created by each particle is amplified within the tube until it can be registered audibly or mechanically.

As shown on the accompanying sketch of a Geiger tube, the glass envelope is filled with an inert gas. Mounted within the tube is a metal cylinder through which a wire passes.

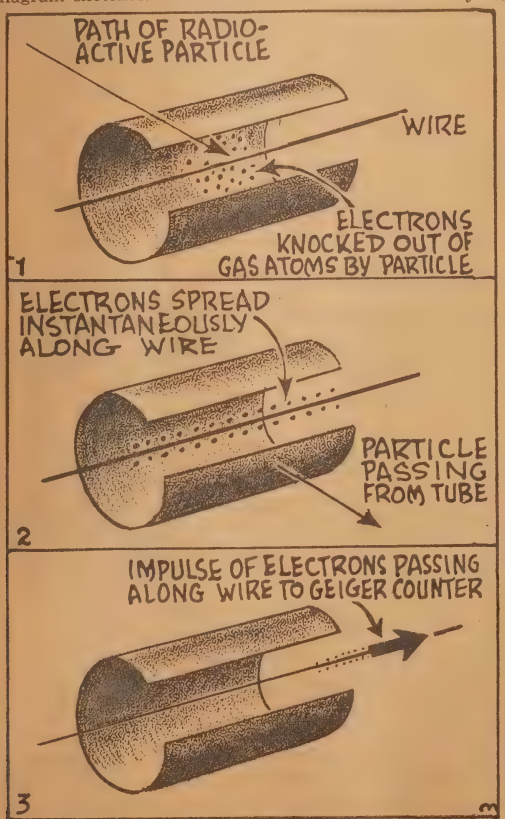
Between the cylinder and wire there is a delicate balance. When a single atomic particle enters the area of tension, the balance is upset.

The sequence of events that follow the passage of a whizzing atomic particle through the tube can be followed in the series of three small diagram-sketches.



An important instrument used in nuclear research is the Geiger counter, which makes it possible to detect the infinitesimal electrically-charged particles given off by radio-active substances and other such particles produced in the atomic research laboratory.

The particle knocks electrons out of the atoms of the gas, and the electrical tension existing between the cylinder and the wire causes these electrons to spread instantaneously along the wire. The electrons multiply themselves by knocking electrons out of other atoms, so producing an electrical impulse on the wire.



The first counter for atomic particles was invented in 1908 by Rutherford and a German named Hans Geiger for research into atomic structure. Improvements have been made in the tube, and in the recording mechanism that goes with it. After the advent of radio, the current from the Geiger tube was amplified electrically until it became strong enough to operate a mechanical recording meter. This meter was an adaptation of the device used in recording the number of calls made by a telephone subscriber.

These did not register quickly enough, however, when the tube was near an active source.

More recently radio circuits have been developed by which counters can record particles coming as fast as 20,000 a minute.

The Geiger counter is versatile. It can detect cosmic rays, gamma rays, ultra-violet radiations and X-rays as well as atomic particles.

As with the photo-electric cell, with which it has many points of resemblance, the Geiger tube can be connected to relay mechanism. It is so sensitive that it will operate a fire alarm response to ultra-violet radiation from a burning match.

Geiger tubes are produced in various forms, according to their intended use. Large tubes—3ft or more long—are used to pick up rays and particles that are few and far between. Small tubes—a few inches long—are used for detecting active substances.

ENGINE ROAD-TEST SIMULATED

BEST techniques for determining motor fuel octane rating requires actual road conditions. Laboratory stop-and-go city driving can be simulated by a dynamometer control device employing a closed servo system.

This system, designed by the Shell Development Co., uses a speed sensitive tachometer generator, crankshaft driven, to provide a velocity signal and its first derivative (acceleration) to a control unit. A third error channel provides a high-order derivative signal to counteract slow response. These signals drive the amplifier to supply dynamometer field current, which regulates test-engine speed.

RECORD PLAYER

✶ DUO-SPEED

✶ HIGH FIDELITY

Goldring

GOLDRING PRESENTS A RECORD PLAYER which will never become obsolete whatever speed may ultimately be used for DISC RECORDING.

ITS MAIN FEATURES ARE:

- The GOLDRING THREE-WAY PICKUP (No. 150) regarded by many experts as the greatest advance in pickup design.
- A DUO-SPEED MOTOR FOR STANDARD (78 rpm) and LONG PLAYING MICRO-GROOVE (33 1-3 rpm) records.
- BEST QUALITY LEATHERETTE Covered Case can be closed when playing 12" records.
- Independent on-off switch.
- EASY PLUG-IN TO MAINS.

THE GOLDRING THREE-WAY PICKUP (No. 150)

HIGHEST FIDELITY REPRODUCTION.
Easy change from 78 rpm to 33 1/3 rpm by simply changing color coded stylus and moving weight adjustment.

OUTPUT	:	150 mV.
FREQUENCY RANGE	:	30—16.000cps.
STYLUS PRESSURE	:	14 grms (78 rpm)
		7 grms (33 1/3 rpm)
OPTIMUM LOAD	:	50,000 ohms

SAPPHIRE STYLI (supplied with PLAYER)
BLUE : 0.003" for Standard Records
YELLOW : 0.001" for 33 1/3 rpm Records
REPLACEMENT STYLI : 15/- each.
Also available GREEN : 0.0025"
ORANGE : 0.0035"

THE DUO-SPEED MOTOR

Ideal for playing both standard and long playing records.

Rim driven 4 pole motor of advanced design assures low rumble.

No stray field radiation.

Uniform turntable speed.

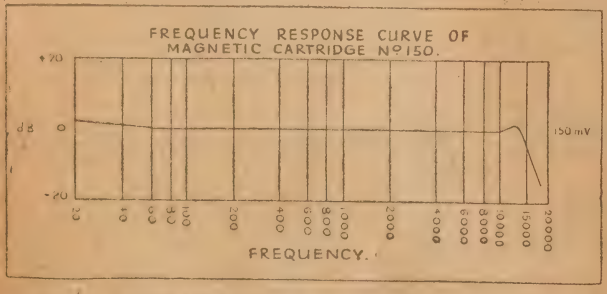
Instantaneous speed variation (wow) at absolute minimum.

Self lubricating bearings ensure quiet running and long life. Need no oiling.

Speed change from 78 to 33 1/3 rpm effected in a few seconds by merely reversing main pulley drive.

10" HEAVY PRESSED STEEL TURNTABLE Supplied connected to 200/250 volts but change to 100/125 volts is accomplished easily.

PLEASE NOTE: The unique design of this PICKUP using stylus as ARMATURE does not permit use of other styli or needles. 45 rpm RECORDS when available will be played with same stylus and weight as 33 1/3 rpm records.



Should records using any other speed become available, adaptors will be supplied at small extra charge.

Design of suitable pre-amplifier and equaliser supplied with each player.

Price £17/15/- (Incl. 25% Sales Tax)
(Interstate slightly higher)

GOLDRING ENGINEERING (A/SIA) PTY. LTD., 57 H.E. AREA, ST. MARY'S, N.S.W.
Phone: St. Mary's 447. After Business Hours, UW6907

NEWS AND VIEWS OF THE MONTH

Television pangs

ELSEWHERE in the issue we have detailed the general trade reaction to the introduction of color television in the United States. One newspaper report sums it up nicely by saying that a child has been born which nobody likes except the mother and doctor. Mother is the Columbia Broadcasting System and doctor is the US Federal Communications Commission, which has the say in such matters.

The rival in the piece, the powerful Radio Corporation of America, claims that the system adopted is a crude and quick answer to a problem which is capable of a much better solution. Apparently the trade, by and large, agrees with this contention, if only for commercial reasons.

The farcical aspect is that the FCC apparently appreciates this point of view. It is also well aware that there is a "dark horse" in the field in the form of a completely new and compatible system being developed by the General Electric Company.

Should either the RCA or the GE system come good—and their sponsors believe they will — they will almost certainly claim the support of the entire industry outside the CBS. The FCC will then be faced with three sets of standards and the CBS color sets, introduced as a guard against obsolescence, will themselves become back numbers.

From this remote distance the action of the FCC has all the appearance of being very premature. By the time Australian stations are ready for action the position should be a whole lot clearer and the authorities can act appropriately.

It seems painfully obvious that the ultimate solution must be a completely compatible system which will allow for cheap monochrome receivers or expensive color sets, whichever you can afford, and both capable of receiving the same programmes. And if color programmes are not available all the time the stations carry on in monochrome and no-one has to miss out.

Not enough actors

ON the programme front it is becoming apparent that there isn't enough talent to go round, even in the US.

If a show is good enough most of the audience sees its first performance and after that nobody is interested in it. You can't go on showing night after night to a theatre-full of patrons and collect fees on that basis. All the rehearsal time and the period between shows must be covered by a single spot fee. That is why Hollywood stars like Ann Sheridan and Gloria Swanson collect anything up to 5000 dollars for a single appearance in a top show.

Cost of receivers

TELEVISION retailers, meanwhile, are in a "flap," first on account of the color question and secondly by reason of new regulations governing credits and time payment. Prospective viewers are being cautioned to wait by CBS and urged to buy by everyone else. If they do decide in favor of a new receiver they have to find a substantial portion of the total price for the down payment.

Electronics

A RUN through some of the current technical magazines underlines the terrific degree to which electronics, as a whole, is penetrating every branch of science.

A recent development from the Mayo Clinic is an entirely automatic method of anaesthesia controlled by the patient's own brain currents.

Investigations have shown that the brain potentials are very slight during deep anaesthesia, but considerable during normal activity. The idea, essentially, is to feed the brain potentials into an electronic amplifier and integrator, which generates an impulse whenever it is triggered by the rising amplitude of brain potentials. The impulse is used to operate a single-stroke pump which administers additional anaesthetic to the patient.

Means are provided to control the depth of anaesthesia and also to limit electrical "hunting" effects which might administer the inhalant in a cyclic rather than an even fashion.

Radio control

STILL on the subject of electronics, it is interesting to note that Australia has built and successfully operated a high-speed radio-controlled jet aircraft. While it may use well-established principles it does show that local scientists are grappling with problems which will inevitably arise in future military operations.

There will always be a vital task for fully-manned vehicles of war, but there is an obvious future, too, for "disposable" planes, tanks and ships which can be sent in to vital areas with the sole idea of destroying themselves and everything else within range.

Jets v. props

AN interesting sidelight on the Korean war has been the chance to observe the relative merits of the jet fighters with the Mustang—probably the best all-round prop-driven fighter from World War II.

The jets are terrifying in their first impact, but noise and speed alone do not kill. Operating from a distant base their time over the tar-

UMBRELLA ROOF FOR AUDITORIUM

A spectacular engineering feat is represented by this "umbrella' type roof planned in USA. In open air performances, the roofing folds into a narrow segment supported from a central point. To close the roof, the sections open out on each side so that, when fully extended, the roof has the appearance of a huge umbrella.

get is too limited. By comparison, the Mustangs have been able to "stooge" around and find targets, having all the speed and striking power necessary to give a good account of themselves.

However, the power plant of a Mustang and fighters of like design is a hopeless array of intricate machinery. The supercharger is enough, let alone the motor.

The jet engine has a functional simplicity which must win out in the long run, but its economy will have to be improved and efficiency raised at low flying speeds.

Other lessons

US Army Intelligence reports have had plenty to say about other weapons. Here are some of the comments:

- Soviet tanks are better than American—more armor, bigger guns. But American fire control is better and the new General Patton, now going into production, may turn out to be the most manoeuvrable tank of all.
- The recoil-less rifle (field gun), though good, is not the super-weapon some ordnance experts forecast it would be. It is too heavy, its ammunition is too heavy and it makes too much blast and flash when fired. The rifle is not a good weapon for anti-tank work.
- The 3.5-inch bazooka has wonderful penetration but such a flash that the first shot gives away the firer's position. But it was one of the most useful weapons of the campaign. Not as accurate as the recoil-less rifle, it is very mobile and a good anti-tank weapon.
- Signal equipment used in Korea was mostly World War II vintage. A new walkie-talkie was clearer and stronger when it worked, but there was so much trouble with transmission that the signal corps is likely to begin a big drive for better radio gear. One very good new piece of gear was new telephone wire made of aluminium and weighing only 47lb to the mile.
- The helicopter so impressed the commanders in liaison, observation, communications, rescue, supply and patrol-dropping work that the Department of Army wants all the helicopters the budget controllers will grant.
- The tactical air force position is peculiar. Korea showed that MacArthur's forces had, practically speaking, no proper tactical, as distinct from strategic air force. During the campaign strategic planes and pilots were often pressed into doing infantry-close-support tasks.

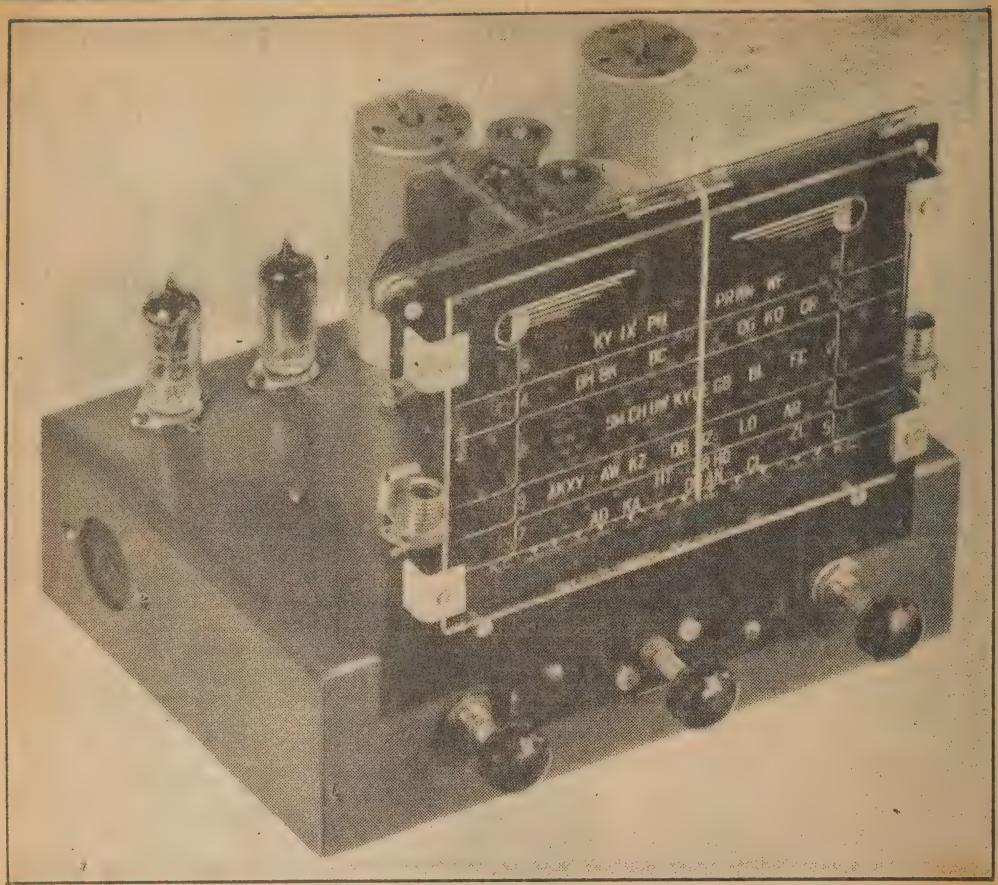
Telecommunications

THE Overseas Telecommunications Commission (Australia) has appointed Mr. J. L. Mulholland its new general manager.

Chairman of the commission Mr. J. Malone announced Mr. Mulholland's appointment.

Mr. Mulholland has been assistant general manager since the commission was established in 1946.

He succeeds Major-General J. E. S. Stevens, who is now permanent head of the Ministry of National Development.



The set looks much like the 4 valve version, but has an extra valve, coil, and condenser section to accommodate the RF stage.

THE R & H PENTAGRID FIVE

Number six in the popular Radio and Hobbies "Kit" series is this standard five-valve all-battery receiver. Featuring an R.F. stage for maximum gain and selectivity, it offers high performance to the country listener for a minimum of outlay and operating cost.

by Raymond Howe

COUNTRY listeners, particularly those with some appreciation of technical matters, need no convincing as to the benefits offered by an R.F. stage. Distant stations can be tuned with ease and signals too weak for smaller sets are often brought up to useful listening level.

During the routine tests in this chassis, we were able to obtain good output from the speaker with a measured input voltage from the signal generator approximately one-half microvolt. Such a figure speaks volumes both for the gain and the signal-to-noise ratio, both of which are improved by the R.F. stage ahead of the converter.

R. & H. KIT NO. 6

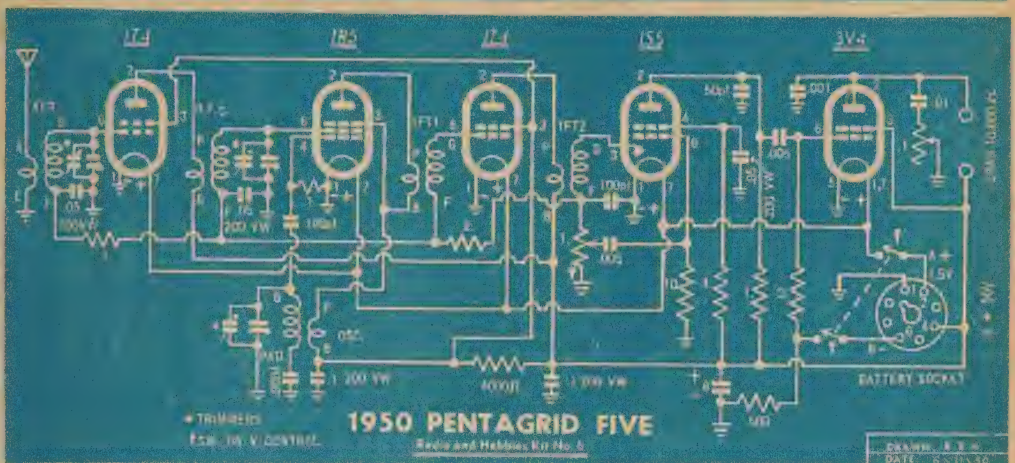
Just how important this might be in practice depends on the individual listener. If you are interested mainly in a few of the stronger stations, then the simpler four valve receiver described recently will meet your requirements.

On the other hand, difficult locations, areas of severe fading, and an interest in DX listening all call for something extra in the way of performance, and you'll vote the larger set well worth its additional cost.

Actually the difference in cost compared with a 4-valve super is not very great and it would not amount to more than a couple of pounds at the outside—a larger condenser, an extra coil, a valve and socket and a couple of wiring parts.

The difference in operating cost is negligible also. The extra filament

CIRCUIT DIAGRAM OF THE PENTAGRID FIVE



Being a standard set, there are no circuit tricks to worry about.

will draw another 50 milliamps from the A-battery raising the figure from the 0.25 to 0.3 amp. You can almost forget the extra high tension current because the added gain of the stage will cut the drain of the stages by AVC action so that, on a typical signal, you may not notice the difference.

High tension drain approximates 12 milliamps from the 90-volt supply.

Quite logically, therefore, the set follows on from the 1950 Pentagrid Four (Radio and Hobbies Kit No. 2) of the September, 1950 issue, but we can treat it nevertheless as a separate design.

Those constructors who have already built the 1950 Pentagrid Four may like to take advantage of the R.F. stage if their particular location demands some increase in the general sensitivity. The necessary additions are small and are easy to make, as the chassis is already punched to take the extra valve and coil.

In keeping with our treatment of the Kit series, we will bypass discussion on the technical make-up of the set, the points considered in its initial design and so on and confine the article to the actual construction.

BUILDING HINTS

To start the ball rolling, let's talk about suitable tools for the job. This matter has received attention in other articles but, for the benefit of new readers, and those who may not have the previous issues on hand, we will repeat the suggestions.

Tools can be divided into two categories, namely, those which are essential and those which are handy. A minimum collection necessary to do the work would be a medium-sized screwdriver suitable for 1-8th or 5BA bolts, a pair of side-cutting long-nosed pliers, a sharp knife and a small soldering iron.

An electric soldering iron will be out of the question with the exception of the type which can operate from an accumulator. In most instances, it will be a case of heating a standard bit over a primus or suchlike. A small size bit will make the job easier. Use a recognised "radio" soldering flux or paste, together with resin-cored solder. Be very sparing with the flux to avoid it getting into places where it shouldn't be.

THE CHASSIS

The chassis for the set will be ready-punched and drilled for you, so the first step in the actual construction is to mount the components. Start with the valve sockets, the speaker socket, battery socket and the aerial and earth terminals. Mount them in the manner illustrated in the underchassis wiring diagram settling them into the chassis holes from the top side.

You can identify the positions of the sockets by the gap between pins 1 and 7. It doesn't matter which way the speaker socket is mounted. Note that the aerial terminal is near the lip of the chassis. Place an insulating washer and a solder lug under the nut of this terminal. Use a metal washer with the earth terminal so as to make contact with the chassis.

We did not use the combination miniature socket and shield because electrical shielding of the valves is not necessary in this case. The main advantage of the use of the combination socket and shield would be the physical protection afforded to the valves.

Now sort out the coils and the intermediate frequency (I.F.) transformers and identify the connections on the bottom, either by the direct markings or by the number code supplied with the components. Using

PARTS LIST

1 Chassis 8½" x 6¼" x 2½" (All Battery Five or Economy Five).
1 Small 3-section gang tuning capacitor (AWA).
1 Dial to suit (USL44 or similar).
1 Broadcast aerial coil, 1 RF coil, 1 Oscillator coil (for 1R5).
2 Standard high-gain 455 kc IF transformers, Nos. 1 and 2.
3 Gang trimming capacitors.
5 Miniature valve sockets, 1 octal wafer socket, 1 4-pin miniature plug and socket.
1 Permagnetic speaker with transformer for load impedance of approx. 10,000 ohms.
1 1.5 volt dry battery and two 45 volt dry batteries (capacity to suit requirements).

VALVES

1 1R5, 2 1T4, 1 1S5, 1 3V4.

CONDENSER

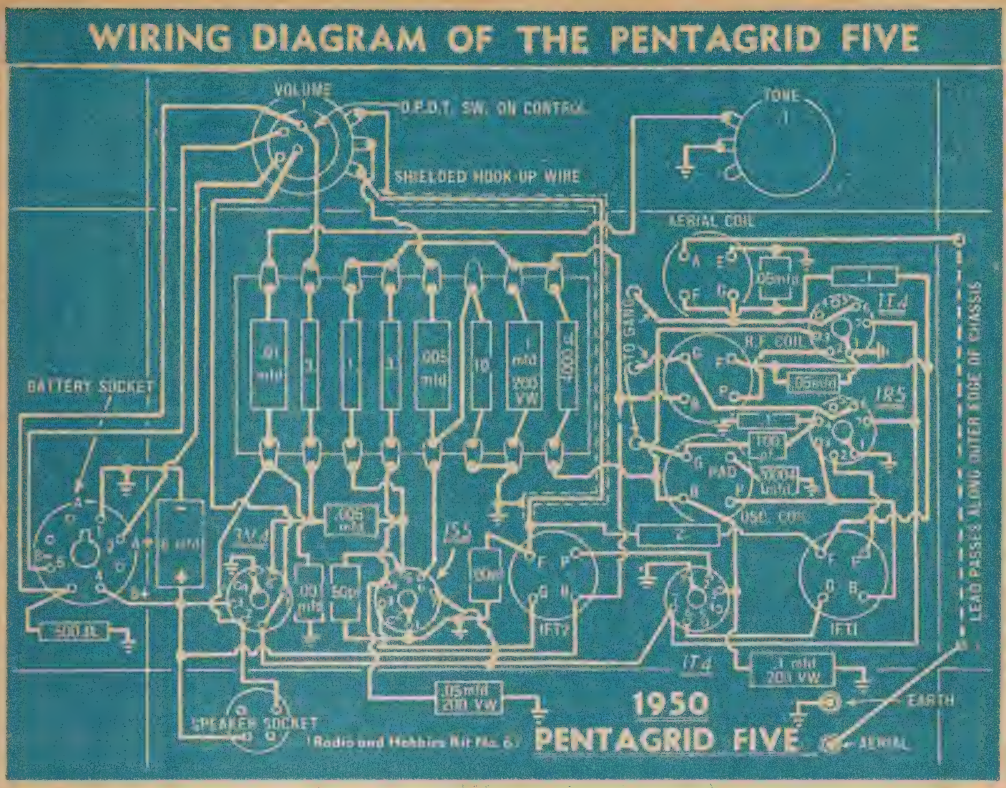
1 8 mfd. electrolytic, 2 0.1 mfd. 200VW tubular, 3 0.05 mfd. 200VW tubular, 1 0.01 mfd. tubular, 2 0.005 mfd. tubular, 1 0.001 mfd tubular, 1 0.0004 mfd mica (low resistance), 2 100 pf. mica, 1 50 pf. mica.

RESISTORS

1 10 meg., 2 3 meg., 1 2 meg., 1 1 meg., 1 meg. potentiometer with DPDT switch, 2 0.1 meg., 1 0.1 meg. potentiometer, 1 4000 ohm, 1 500 ohm.

SUNDRIES

2 Terminals (1 red, 1 black), 3 knobs, 4in of terminal strip, approx. 7in of shielded hook-up wire, spaghetti, a few feet of tinned copper wire (20 SWG or thereabouts), 2 1in by ¼in bolts, solder, solder lugs, hook-up wire, nuts and bolts, etc.



This wiring diagram will be a great help if you are not an experienced builder.

the wiring diagram once again, mount them in their appropriate holes in the chassis. Avoid excessive tightening of the nuts on the holding-down lugs of the coils and transformers, as too much pressure can pull the lugs away from their eyelets.

THE COILS

The coils are identified as "Aerial," "R.F." and "Osc." Make sure that you don't get them mixed. The two IF transformers have differing characteristics demanded by their position in the circuitry. The one with the lead protruding from the top of the can is the one for the No 1 position, that is, after the IR5 converter valve. The other transformer will have no such lead protruding, and is the one for the No. 2 position. In many cases, they will be appropriately marked in this respect.

The protruding lead on the No. 1 transformer really connects to the "G" pin inside the can, and is brought out of the top of the can for convenient connection to IF amplifier valves which have their grid connection at the top of the valve envelope. With these miniature valves, the grid connection is brought out through the base of the valve envelope and the connection between the valve and IF transformer is made under the chassis.

However, the protruding lead from the top of the transformer can not be left lying loose. Dispose of it by cutting it off to within about 1-8in. from the top of the can or by removing the innards from the can and cutting the lead off close to where it is soldered to the "G" pin. It doesn't matter which way you do it but, if you attempt the latter method, be very careful to avoid damage to the fine wires when removing and re-inserting the actual transformer in the can.

In the wiring of the set, there will be a number of occasions when it will be necessary to make connection to the chassis, or "earth" as we will call it. To this end, it is usual practice to place solder lugs under nuts holding the major components to the chassis.

EARTH PONITS

Viewing the underside from the position depicted in the underchassis wiring diagram, place one under the right-hand bolt of the aerial coil, under the right bolt of the IT4 RF socket, the left bolt of the RF coil, the right of the IR5 socket, the left of the 1T4 IF socket, under both bolts of each of the IF transformers, on the right of the 1S5 socket, on the left of the 3V4 socket, on the right of the speaker socket and under each of the two bolts holding the octal socket.

Make sure that the bolts used for these solder lugs make good contact with the chassis, scraping a little paint from the chassis, if necessary.

MOUNTING CONTROLS

The final step before commencing the actual wiring is to mount the volume and tone control, the tuning gang and the dial. The wiring diagram indicates a suitable way in which to point the lugs of the two controls. In fitting the tuning gang into place, make sure that, when the bolts are tightened, there is no strain or twist transmitted to the frame of the gang.

Just before mounting the dial, remove the screw securing the drum to the dial plate. Push the drum onto the tuning gang shaft and bolt the dial into position. This method of mounting avoids the necessity of accurate physical alignment of the dial and gang and, indeed, is the correct way to mount a dial drive of this type.

There is not a great deal to the actual wiring of the set, but in the interests of convenience, it is better

Resistor Color Code

VALUE	BODY	END	DOT
10 megohm	Brown	Black	Blue
3 megohm	Orange	Black	Green
2 megohm	Red	Black	Green
1 megohm	Brown	Black	Green
0.1 megohm	Brown	Black	Yellow
4000 ohms	Yellow	Black	Red
500 ohms	Green	Black	Brown

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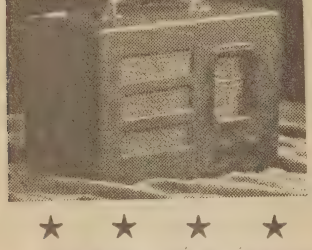

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1 - 3745 "

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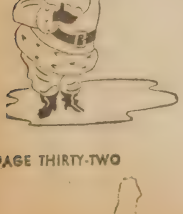

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to carry out the job with some sort of logical sequence.

Commence by earthing of the centre spigot of each valve socket to the negative filament pin of the socket, and thence to the nearest solder lug. Now connect all solder lugs together with a run of tinned copper wire, say 20 SWG or thereabouts. This step removes the possibility of one or more earth points not making good contact with the chassis.

Earth pin 1 of the battery socket to the solder lug near to it and run a wire from pin 2 of this socket to one side of one pole of the switch on the volume control. The other side of this pole of the switch connects to pins 1 and 7 of the 3V4 socket and thence in turn to pin 7 of each of the other valve sockets. This completes the filament circuit. With the aid of a multimeter or a battery and torch globe, you can find out which of the four lugs on the DPDT switch on the volume control are associated.

WIRING

Now put in all those leads which run from valve sockets to coils or IR transformers, from coils to tuning gang sections, from the speaker socket to the 3V4 socket and from the aerial terminal to the aerial coil. Note that this aerial lead runs along the outside of the chassis and re-enters near the front edge. This is to avoid unwanted coupling with the remainder of the wiring.

While on this part of the wiring, instal the B-plus lead from the battery socket to the 3V4 socket or the speaker socket and the runs from pins 5 and 6 on the battery socket over to the switch on the volume control. Wire the 500 ohm resistor from pin 5 of the battery socket to the earthed solder lug just near it.

The next step is to wire in those components which are not mounted on the terminal board. This will take in the A.V.C. resistors and bypass capacitors, the oscillator grid resistor and capacitor, the padding capacitor, the screen bypass capacitors and those components grouped around the last two valves.

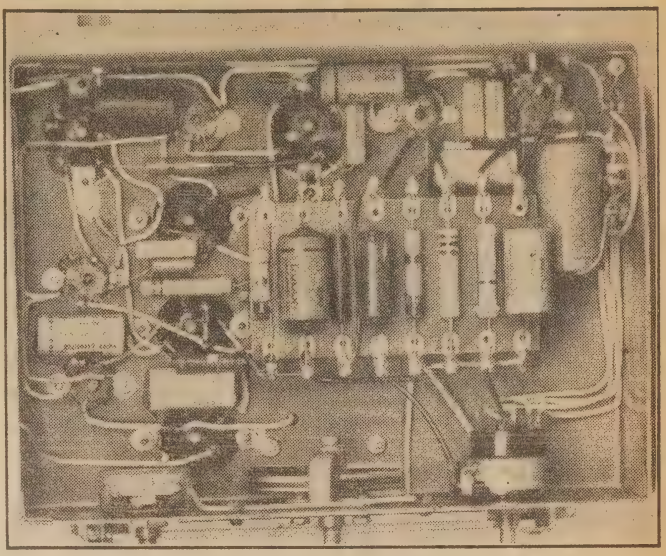
CONDENSER CONNECTIONS

Speaking about these tubular capacitors, you will notice a small "blob" near one end or, where there is a label, there will be a black ring printed thereon near one end. The pigtail at this end of the capacitor is one which should be connected to earth or chassis when the diagram indicates so. With the 8 mfd. electrolytic capacitor, the red end is positive.

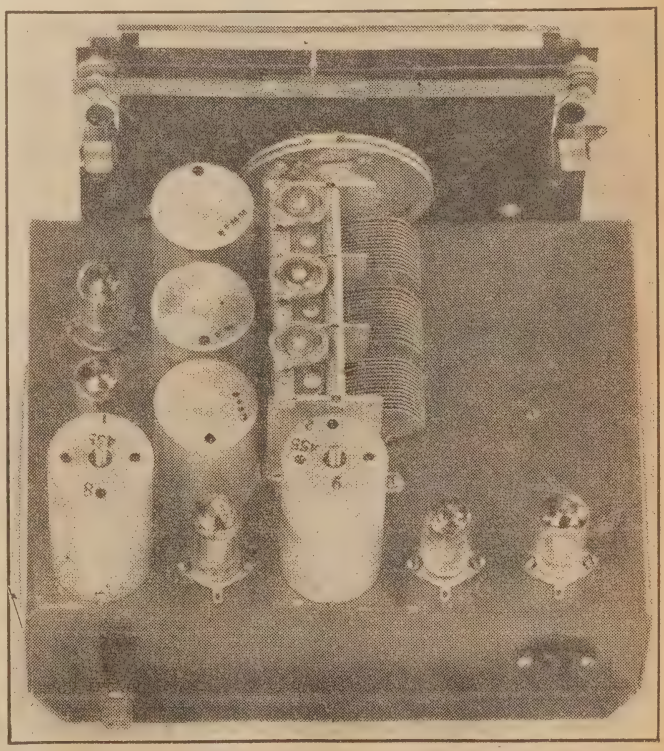
The final step in the underside wiring is to mount the eight appropriate components onto the terminal board in the order shown in the wiring diagram, mount the board into place with the 1inch by 1-8in. bolts and wire the terminal lugs to their particular place in the circuitry.

To complete the job, turn the set right side up and mount the gang section trimmer capacitors onto the section of the tuning gang. Note that the stator plates of each section of the tuning gang has two lugs, one at the bottom and one at the top. Naturally, the bottom lug is used for the connection to the coil, and, from the viewpoint of accessibility, the trimmers connect from the top lug to the frame of the gang, the frame, of course, being earthed to the chassis by its mounting bolts. The top plate

VIEW UNDER THE CHASSIS



Compare this photograph with the underchassis wiring.



The full chassis layout is shown here.

of each trimmer should be the one which connects to the frame of the gang, thus earthing the adjustment screw.

BATTERIES

Well, that's the story. Incidentally, we did not show the dial lights as being wired into circuit mainly from the point of view of keeping the A Battery drain down to a minimum.

In the connection of the batteries to the set, there rises a point worthy of mention. Although we show an octal socket carrying the battery leads into the chassis, this is open to variation. You can replace it, if you prefer, with a chassis-mounting plug or simply take the leads straight through to their particular point of connection in the set wiring, bearing in mind that battery manufacturers now provide connecting sockets on batteries.

We chose to retain the octal socket, however, to be consistent with the "Pentagrid Four" set. The socket also constitutes a handy anchor point for the associated wiring.

The point in favor of reversing the plug and socket is that there is less chance of the batteries being shorted if the socket is lying free with the cable attached to the batteries.

Before giving the set its initial test, go over all of your wiring to make sure that it agrees with the wiring diagram. See that all joints are good and solid, that no solder droppings or strands of wire are shorting any connections to one another or to the chassis.

Now connect the batteries, but leave the valves out of their sockets. Wire a couple of leads to a torch globe and test each valve socket filament wiring by touching the leads between pin 1 and on each socket and earth. If the globe glows at each position, it indicates that the filament wiring is OK, and that it is safe to plug the valves in.

Be careful with these miniature valves when inserting them into or removing them from the socket. Avoid too much side pressure. Ideally, a dummy plug or valve should be inserted into the socket during the wiring process to avoid misalignment of the socket sleeves.

THE SPEAKER

The size of speaker will depend upon what use you have in mind for the set. An 8-inch speaker is a good all-round size. The speaker will obviously need to be of the permagnetic magnet type and should have an output transformer attached to it to suit a load impedance of the order of 10,000 ohms.

We have in the past on many occasions given details of the alignment procedure for a superhet receiver and to obviate too much repetition we made available through our 1/- Query Service complete details in pamphlet form on such procedure.

However, at the risk of its becoming monotonous, we will give the broad details here in order to round off the discussion on this set.

The first step is to see that there is equal overlap of the dial pointer at each end of its travel. If necessary adjust the position of the dial drum drive on the tuning gang shaft so that this is so.

Attach an aerial and earth to the set and tune in a station towards the high frequency end of the dial. Adjust the aerial and R.F. gang section trimmers for loudest volume and see if the station corresponds with its marking on the dial glass. If it does not, adjust the oscillator trimmer until it does. You will find it necessary to follow each adjustment of the oscillator trimmer with readjustment of the aerial and R.F. trimmers.

ALIGNMENT

Now tune in a station towards the low frequency end of the dial, that is, somewhere around where station 2FC appears. If the station selected does not correspod with its position on the dial glass, adjust the slug protruding from the bottom of the oscillator until it does. Whilst listening to this station, adjust the slugs protruding from the bottom of both the aerial and R.F. coils for maximum volume.

These adjustments may have altered the alignment at the high frequency end, so tune in again the station previously selected at that end of the dial and go through the trimmer adjustments again. If a large readjustment is necessary, repeat-the-low-frequency-end adjustments. However, in most cases this will not be necessary.

The final step is to tune in a comparatively weak station and adjust the slugs protruding from the top and bottom of each of the IF transformers. Go through the procedure twice to counteract any interaction between adjustments.

Well, the set is now ready for real service, and if it doesn't meet with your expectations as regards sensitivity, we'll eat the proverbial hat.

One or two points to remember are to keep the leads to the speaker as short as possible within reason, and keep them away from the aerial lead. If slight instability is encountered at the extreme low frequency end of the dial, attach an earth wire to the earth terminal. It's a good plan to use an earth wire anyway, particularly on a battery-operated set.

If you are one of those home-builders who constructed the 1950 Pentagrid Four and would like to have the benefit of the R.F. stage, we

assure you that there is very little modification necessary. First of all, decide whether you require the extra sensitivity, for there is no point in adding the R.F. stage if you really don't need it.

The modifications to be made are to replace the existing 2-section gang with a 3-section, replace the aerial coil with an R.F. coil, preferably of the same manufacture, and mount the aerial coil in the hole provided for it near the dial. Insert a miniature valve socket in the hole also provided in the chassis and wire the new stage according to the appropriate portion of the wiring diagram. The two additional components underneath the chassis are the 0.05 mfd. capacitor and the 0.1 megohm resistor. Re-route the lead to the tone control around the dial cut-out as shown in the underneath photograph. Re-align the aerial and R.F. coils and gang section trimmers in the usual manner and the job is done.

STEREOPHONIC

(Continued from Page 17).

speaking as he went, from one microphone to the other, the listeners in Washington could follow his movements as easily as if a single loudspeaker had been moved about on the stage of the hall in which they were sitting.

The outstanding merit of the improved system of stereophony, due to Jose Bernhart and Jean Wilfrid Garrett, with which the French broadcasting authorities have recently experimented, is that it combines all the advantages of that tried out some years ago by the American Telegraph and Telephone Company with the facilities for deceiving the ear offered by the system using a single microphone and two transmission channels.

In the improved system a number of microphones may be used; but transmission takes place on two channels only. The basic feature of the system is that the output of every microphone is fed through faders to both channels. Thus either of the listener's loudspeakers can be made to receive at will a suitable "ration" of the output of any microphone.

The less active the controller, the more closely does the working of the improved system resemble that of the old ATTC sterophonic system. Hence, it is readily adaptable to direct transmission from theatres and concert halls.

On the other hand, when the controller wants to show what he can really do, he can make sound-sources which are, in fact, fixed, appear to move about it any way that he fancies—and he can do this with speed and flexibility that it would be difficult to match.

During the transmission of Une Larme du Diable, four microphones were in use. The effect of "depth" was produced by means of an echo room. By these means an utterly amazing acoustic perspective was brought into being, with no sacrifice whatever of classic production methods.

FOR THE JUNIOR EXPERIMENTER

It isn't always easy to keep a clear picture in mind about tuned circuits. What is L/C ratio? Is a high selectivity circuit also a high "Q" circuit and if not why not? Get these firmly in mind, and radio circuits will be easier to understand. This article explains them for you.

TO start at the beginning, tuned circuits are made up of coils and condensers. In technical sign language, a condenser looks like this.

Some refer to a condenser as a "capacitor" which is its correct name. The distinctive property is "capacitance" and this is shortened, very logically, to "C."

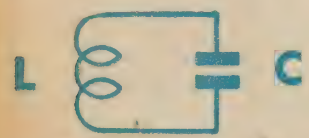
You often read about the "reactance" of a condenser or about "capacitive reactance." Those terms merely describe the special kind of resistance a condenser offers to alternating current. It's still measured in ohms, the same as ordinary DC resistance!

Then there's the coil, which looks like this in a circuit:

Coils are made from wire, and because of their ability to create an electro-magnetic field, possess the distinctive property of "inductance." For want of a more suitable letter, this is denoted by "L."

Coils also offer a special kind of resistance to alternating current, and this goes by the name of "inductive reactance." If you want to be very clever, you can write XL for inductive reactance and Xc for capacitive reactance.

Put a coil and a condenser together, like this:

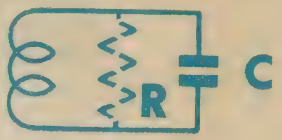


and you get a tuned circuit. In fact, if you want to be terribly highbrow, you can call it a "parallel-tuned circuit" because the two components are essentially in parallel.

Actually, the previous drawing isn't quite honest, because tuned circuits never do have just L and C in their make-up.

Blame who you like, but every coil that was ever made has some resistance as well as reactance. Come to think of it, there never was a conductor that hadn't some resistance, no matter how small.

So, to be perfectly honest, the tuned circuit should be drawn like this:

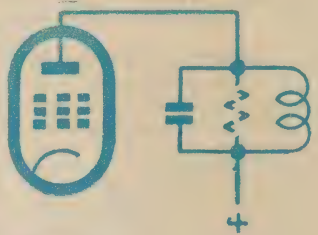


The condenser and coil are drawn solid because they're obvious physical units. You can pick 'em up and handle 'em if you want to. The "R" is a different kettle of fish, so it's dotted in. You know it's there but, like a spook, it lacks tangible form.

This might sound a bit abstract but it's really important, as you'll see later.

What happens when we begin to make use of a tuned circuit, in the plate circuit of a valve, for instance? How do the values of L, C and R affect the amplification?

Let's look at a typical circuit of this type.



Cutting out a lot of "ifs" and "buts," the gain of an amplifier in a hookup like this depends roughly on the formula:

GAIN equals Gm x RL;

where Gm is the transconductance of the valve (you can get that from a valve data sheet) and RL is the effective load impedance—in our case, the impedance of the tuned circuit.

It's obvious, therefore, that stage gain will be higher with a valve which has a high Gm as against one with low Gm.

CIRCUIT IMPEDANCE

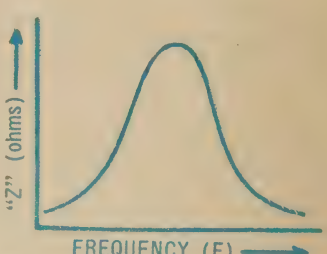
But the gain also depends on the impedance of the tuned circuit. And so we establish one important point—for high gain we want a high impedance tuned circuit.

But what is this term "impedance" which we slipped in on the side?

You see it's this way. When considered as the load for a valve, the tuned circuit involves the complex properties of a coil, a condenser, and this intangible resistance we've already mentioned. So, to save getting into too much bother, we lump them all together, call the result "impedance," and tag it with another letter —this time "Z."

Already we have put several important aspects of tuned circuits in their places. Now to consider a few more—Resonance, for instance, and Selectivity.

By way of pictorial example, we'll make a simple graph showing how the impedance of a coil changes at various frequencies. At one section of the curve, we'd find something like this:



Now that's mighty interesting, particularly the bump in the middle, where the impedance rises sharply. It happens in the region of a specific frequency which is called the frequency of "resonance." Therefore, if you want to make a valve (or several valves) amplify at a particular frequency, you make all the tuned circuits you can find resonate at that frequency.

Come to think of it—that's how you tune a set. Funny how these things work out in practice!

It's pretty obvious, too, if you want to get a lot of gain, you make the impedance at resonance as high as you can.

DYNAMIC IMPEDANCE

Just to give it a name, the impedance at resonance is known as the "dynamic impedance" or the "dynamic resistance" of a tuned circuit.

Of course, it's all very well to say that, but how do you make it high? Well, we'll have to work out another of those tell-tale formulas. Now, let's see . . .

"Resonance occurs at that frequency where the inductive reactance of the coil is equal to the capacitive reactance of the condenser. In other words, where XL is equal to Xc . . ."

No, that's not what we were looking for. But it emphasises one point —inductance reactance increases with frequency while capacitive reactance decreases. It's pretty obvious, therefore, that if you are interested in a

particular resonant frequency, you can balance them by using a big coil and a little condenser, or a little coil and a big condenser, or a medium sized one of each.

Not that there's anything new about that. Home builders have known it for years. You can strip turns off a coil and still log the same station by turning the condenser in a bit further. Or you can add turns and back off the tuning condenser.

But we're still looking for that formula. Ah, here it is:—

Rd equals L/Cr;

where Rd is the dynamic resistance, L the inductance, C the capacitance and r the resistive loss, which we've already mentioned.

You'll remember we want to make Rd large, because that is going to mean high circuit gain. Looking at the formula, one doesn't have to be an Einstein to see that Rd will be large if L is large and if both C and r are kept small.

Well, what do you know? This must be the reason for all the talk about a high L/C ratio — plenty of coil and not much condenser for high gain!

ABOUT "R"

But what about this "r", this intangible but very damaging circuit loss? It's about time we pinned it down.

Fellows who study these things have discovered that high frequency energy is very choosy about where it flows and where it doesn't flow. In a coil, it hugs the outer skin of the wire and avoids the inside like a plague. In other words, the inside of the wire doesn't do any work at all, and the resistance to high frequency is much higher than it would be to a direct current.

Showing characteristic brilliance, engineers invented a name for the effect. Yes, you've guessed it — "skin effect" resistance.

You can get over it quite easily by using a nice, big fat wire, with plenty of skin! Or you can wind the coils with tubing, which is all skin! Now, that's very simple for a short-wave coil, needing only a few turns on a small former, and it's the best way to make short-wave coils.

But just imagine winding up broadcast coils and IF transformers with several hundred turns of 16 gauge copper!

For a time, manufacturers of the popular small coils just had to put up with mediocre performance, because they couldn't get around this "r" business.

LITZ WIRE

But, then someone had a really bright idea and a very original one—let's make wire with more skin! How? Make it of tiny insulated strands, of course, spin them together, and wind the coils with that!

Ever heard of "Litz" wire? Well, that's what litz wire is.

Before long, someone else got the idea of pushing an iron dust core into the coil to give the same inductance with fewer turns. They shut the coils right up inside an iron-dust jacket and even painted them with iron impregnated wax. The result was a coil using a minimum quantity of low-loss wire with plenty of dynamic resistance and providing good stage gain.

But what about the condenser, doesn't it cause loss too? Well, yes. but the loss is generally so small that it doesn't matter. In the long run, the "goodness" of a tuned circuit is determined by the coil.

Just as you might expect, engineers have allotted a letter to this "goodness" factor. This time it's "Q". All this talk about "High Q" simply means that the circuits concerned are pretty good.

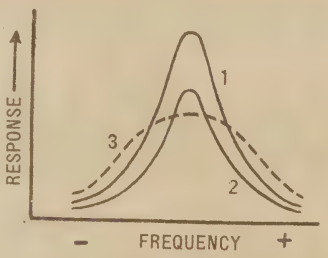
HIGH Q CIRCUIT

But don't run away with the idea that High "Q", high dynamic resistance, and high gain are all the same.

If we just wanted high "Q", we could concentrate on a low inductance high efficiency coil, use plenty of good "C" and end up with a pretty fair "Q".

The trouble would be that the L/Cr ratio, and the dynamic resistance—the factor that has so much to do with gain — would be way down, and gain would be low.

How does all this work out in practice? Let's look at another little graph.



Suppose someone wants to design a broadcast coil with plenty of gain and high selectivity. Right! He winds the coil with the best litz he can find, instals an iron-dust core or yoke, and aims for the highest practical L/C ratio. The result might be like curve 1.

There aren't any scales on the curve but why make it hard? The peak is nice and high, indicating good gain, and the sides slope away sharply, showing that it will reject adjacent signals.

Most modern broadcast coils follow this pattern. On short waves it's often more convenient to use heavy, solid wire. The core is often omitted, too, because it isn't so effective as on the broadcast band.

GAIN AND SELECTIVITY

Let's say, on the other hand that the designer wants less gain but the same selectivity. This means a lower dynamic resistance but a good figure of "Q". Right! He winds a good coil with lower inductance, tunes it with a higher C, and Bob's your uncle!

On the other hand, he might decide to follow one of these modern fads and aim for a broad-band response. They do it, you know, in television and VHF sets.

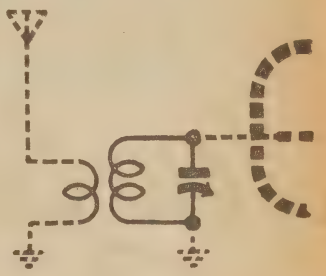
Our hero eliminates all the external tuning "C" so that he's left only with stray circuit capacitances across the coil contributed by the valve, the wiring and the coil itself. Then he winds on turns until the coil resonates at the right frequency, giving a colossal amount of L and very little C. To make the circuit broad, he includes plenty of "r" by using fine wire in the coil, or by "loading" the coil with an external resistor, or even using the coil with a valve having a low grid impedance which tends naturally to load it.

Whichever way it goes, he ends up with a woeful "Q", not a great deal of gain, but a circuit which doesn't have to be critically tuned.

It's a downright shame the way people make a mystery out of all this. There's nothing even smart in the scheme — just a bit of juggling with the Rd and the Q of some wire!

There's another letter — "M" which allegedly refers to the coupling between a pair of coils. I'll admit that it's a bit hard to define at times, but it's still just coupling.

For an aerial coil, you provide a primary and a secondary and draw them like this:—



Don't worry about the dotted parts, they merely show a bit more of the circuit. There are various ways of emphasising the coupling between a pair of coils but the idea of drawing them back-to-back is good enough for most people.

In ordinary tuning coils, only one winding is made resonant but, in I.F. transformers, it is usual to tune both the primary and the secondary.

This gives the high-brows a glorious opportunity to rave about coupling factor and so on, but there's really only three degrees of "M," or coupling—tight, right and slight!

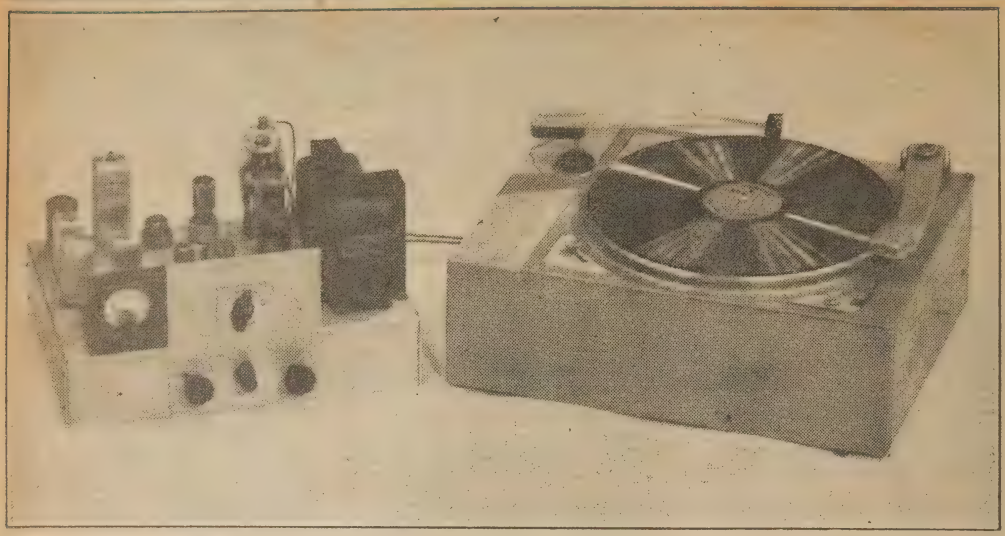
TIGHT COUPLING

Tight coupling gives good gain but poor selectivity. "Right" coupling, which the highbrows refer to as "critical," gives the best all-round results. Slight coupling drops the gain a bit, but pushes up the selectivity.

Designers have taken advantage of these simple facts. Most of the general-purpose I.F. transformers you buy have iron cores, litz wire and a fairly high L/C ratio. The coupling is somewhere around the "critical" mark and they're just the shot for 4/5 superhets.

If you want a two-stage I.F. channel, they'll supply you with lower gain transformers, but with either

(Continued on Page 100)



Our favorite combination for radio recording is this FM receiver. The meter at left is the almost essential level indicator. Bottom left is the volume control, then the main switch, then a high note boost switch. With FM however, this is scarcely worthwhile. The Acos pickup is used for playback.

You Can Make Records at Home!

Hundreds of people are now making their own disc records at home with the aid of recording units and special amplifiers. We have published several articles dealing with such amplifiers, but so far, nothing much to tell you how to make records from your radio receiver. In the next few months, we intend to cover the disc recording field commencing with the simpler forms, and probably ending up with a complete recording unit for the man who wants to get the best possible results.

by John Moyle

FIRST of all, to answer a few queries about recording generally and what can be done about it.

At the moment, disc recording seems to be the best for all but the advanced experimenter. Equipment of good quality is fairly readily obtainable, together with accessories, although the cost is initially rather high. Discs, too, are undoubtedly convenient, and can be played back with standard pickups and amplifiers. For special work, particularly long playing, the wire and particularly the tape have much to recommend them, but we feel that disc recording will always be popular, and most probably number one choice with the experimenter.

One big advantage with discs is that the high grade and expensive motor required is equally well suited for playing standard gramophone records, and invariably caters for both 78 and 33 1-3 speeds. As modern records and pickups demand a high quality motor, a large part of the recording investment can be set against normal record playing activities. A really good motor is the first step in good record playing, as any enthusiast will testify.

What are the capabilities of the disc recorder, and how good are the records which can be made?

All our remarks for the time being centre on the "Byer Junior" recorder, as being probably the only type universally obtainable as a complete unit. It requires no overhead attachments, and is extremely simple to use. Its cutting head has characteristics essentially the same as others of its type, with the exception, of course, of professional cutting heads, each of which may need individual consideration. They are not the kind of thing you can buy readily in a radio store.

The Byer recorder is made in a cast framework and has a rim-driven turntable for 78 and 33 1-3 rpm. The cutting head and arm are "built

in." The cutting head is guided across the recording disc by a quadrant and worm gear housed under the turntable, so that records are easily removed and replaced. The cutter is engaged by a lever on the turntable, and disengaged when the motor is used for playback.

An extra main spindle and pulley is available to provide the fine pitch for microgroove recording, and it is fitted in a couple of minutes. Thus the unit is extremely flexible, and quite easy to use with very little practice.

Two grades of recording blanks are made by Byer, and there are several other good makes of discs available. These are of the acetate type on an aluminium base, in both 10 and 12 inch sizes, with probably a six-inch type as well.

CUTTING STYLE

Special cutting stylii are made in both steel and sapphire, the depth of cut being adjusted by altering the spring suspension of the cutter. It is, therefore, the effective weight of the cutting head which determines the all-important depth of cut.

Using this or a similar recording unit, one can make records which are really good in quality. The frequency response is limited by the characteristics of the cutting head, the main deficiency of which is in the upper register. With careful compensation, this can extend to about 6 kc. without serious drop, but it is not very much good higher than this.

Records of this order are quite as good as the reproductions from the average radio receiver, for instance, although they are not equal to the latest commercial discs which extend above 10 kc. The general impression of a good home-made disc is extremely satisfactory, and inasmuch as the scratch level is almost removed through the use of acetate blanks, is better than was the normal standard a few years ago.

AMPLIFIER REQUIREMENTS

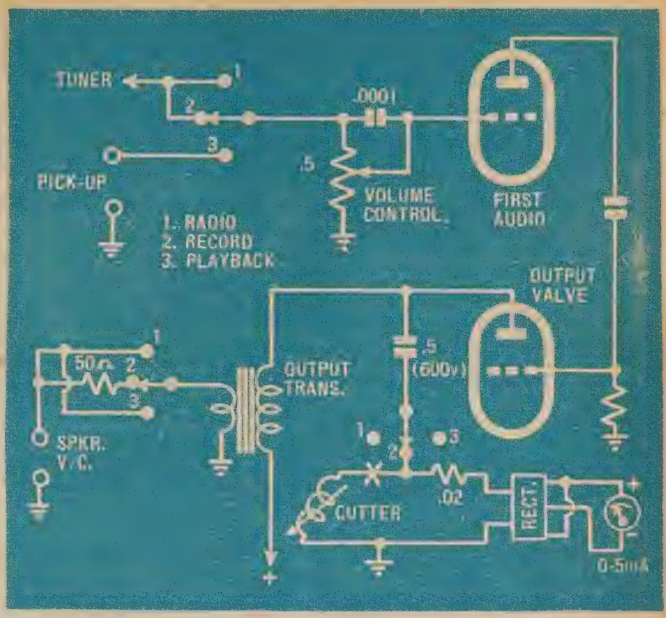
We can, therefore, accept the fact that a home recorder is more than a toy—it provides the means of making records which can be listened to with pleasure.

Having established this point, what are the requirements for an amplifier to drive the cutting head?

Undoubtedly, for the best results, a specially made amplifier is required, not unlike a standard record player type, but with a few devices to correct for frequency loss when cutting, and a switch to allow for both cutting and playback.

There isn't anything hard about such an amplifier, but it is more elaborate, for instance, than the audio end of a radio set. Moreover, if direct recordings in the home are wanted using a microphone, it is doubtful whether enough volume will be obtained without an extra amplifier stage for the microphone.

The main corrections which must be made for recording are, first of all, compensation to level out the response of the cutting head.

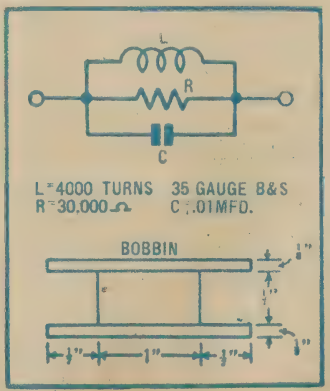


This diagram shows how a 3 x 3 switch is used for recording. Keep the input and output leads well separated to avoid feedback — shielding is preferable. The cutter compensator is inserted at point X. A fixed "high note" condenser can be used, or a second switch to give a choice of values.

The Byer head has a decided rise in output round about the 2000 cycle mark, enough to cause unpleasant effects if it is not removed. Fortunately, this isn't a hard job. We have already published details of a simple compensator in a previous article, and give them again here. The unit increases the amount of power required by the cutter by a small amount, but not enough to worry about.

With this compensator, the objectionable peak is removed, and because of its design, the high frequency response of the head slightly improved.

No cutter should ever be used without its compensation. The need for it is not confined to the Byer alone, but applies to virtually all cutters in a greater or lesser degree. Our values, however, are not necessarily suitable for other cutters.



Here are the dimensions of the compensator unit.

The next compensation generally required is to offset the loss in high frequency response which accompanies the recording process. There are various reasons for this loss, one of which has to do with the radius of the circular cut. This is greatest, as most people are aware, near the centre of the record, and becomes progressively less as the outside is reached.

Incidently, most cutters operate from the "inside out," as against the commercial records "outside in." One reason for this is that the fine thread of acetate cut by the stylus falls away to the record centre much more easily with this method, and does not pile up behind the stylus and ruin the cut.

TREBLE BOOST

Our amplifier, therefore, should incorporate some type of treble boost to even up this high note loss. Ideally it should be applied more heavily at the centre, and decrease towards the outer edge.

In practice, it is impossible to make up this loss altogether, as undue boosting of the highs often causes distortion and is not a complete cure for the radius effect. The best practice is to start the cut not closer than 2 inches from the spindle with 78 records, and 3½ inches with 33 1-3. The slower speed involves much greater loss than does 78 rpm, except

R.C.S. releases new 14/60 filter choke

R.C.S. 14/60 FILTER CHOKE

R.C.S. have now included in their large range of these components a new 14/60 Filter Choke together with the replacement winding.

14/60 Filter Choke Type TC66. Retail 10/-

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R. C. S. also announces a completely redesigned range of Transformers and Chokes

R.C.S. have redesigned the complete range of transformers and chokes, the most noticeable features being the former which is now moulded from high melting point polystyrene powder (so that solder tags will melt out) and completing the component with an aluminium bracket.

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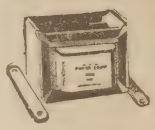
F137 Single High Impedance Pentode	5 0
F138 Push Pull Low Impedance Pentode	5 6
F139 Push Pull High Impedance Pentode	5 6



SPEAKER TRANSFORMERS

TS23 Single Low Imp. Triode	10 0
TS24 Single High Imp. Triode	10 0
TS25 Push Pull Low Imp. Triode	10 6
TS26 Push Pull High Imp. Triode	10 6
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VIBRATOR CHOKES

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TP2 4 volts 1 Amp 7 Watt	12 6
TP3 6.3 volts 3 Amp 7 Watt	12 6
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R.C.S. RADIO PTY. LTD.

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in the case of micro groove, which will be separately dealt with.

In general, therefore, your records will always sound brighter and cleaner over the outside half, although they need not necessarily be too bad nearer the centre. You will remember that even with commercially made records, the last half inch or so near the centre is often well below the standard at the outside start.

Of the two types of cutters—steel and sapphire—the latter is far and away the best, and well worth the extra cost. A steel cutter is fairly good for about 15 minutes of cutting, but deteriorates rapidly after this. Noise level becomes rather high, and there is a marked drop in high note response.

A sapphire cutter, on the other hand, should last for many hours of cutting, and because it is made with polishing or burnishing facets, makes an almost completely silent cut. It also throws the "swathe" or thread cleanly away from the stylus tip, which a worn steel stylus often will not do. The sapphire is more fragile, but once the right cutting depth has been adjusted, only carelessness should damage it before it is worn out.

RADIO RECORDING

We will now apply what has been said to the problem of making records the easiest way, which is through an ordinary radio set.

Frankly, radio programmes are probably the most useful source of recording material, except for the real enthusiast who has good "live artist" material for microphone recording. For the time being, therefore, we will consider recorded programmes, as few receivers are well equipped for handling a good microphone.

Maybe we should say right here that practically everything which is broadcast, particularly recordings, are tightly covered by some aspect of extremely complicated copyrights. Although it is doubtful whether any of these could extend to the use of programmes for experimental work in the home, they are most specific in banning the use of home recordings for other purposes, particularly those involving a public performance. Copyright owners don't exactly go looking for people to prosecute, but we strongly advise you to keep your records in your own library and play them in your own home. If you do, we don't think anyone will worry you, even if they could.

COPYRIGHTS

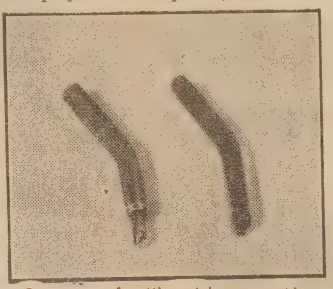
The same copyrights extend, of course, to a great deal of music, and would apply to public performances of your friends performing it.

In other words, don't forget the word "home" in "home recording"!

The average radio receiver has an output stage using a 6V6 or 807, and capable of about four watts output. This is enough to drive the cutter, which calls for about two watts average power, and more on peaks. So that, generally speaking, if the radio set is connected to drive the cutter instead of the speaker, it will make records.

Connection is devised as shown in our circuit. The speaker transformer is in circuit all the time, and the cutter is fed in the "record" position through a blocking condenser of .25 mfds. and preferably 600 volts working. So that the power will be available for the cutter, and not largely diverted to the speaker, a resistor is switched in series with the voice coil when recording. This allows a small amount of power to reach the speaker, which is then used to monitor what is being recorded. The cutter has an impedance of about 4000 ohms, which matches fairly well into almost any output valve.

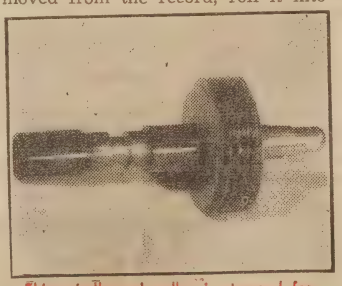
After the record has been made, and playback is required, the switch



Two types of cutting stylus — sapphire and steel. The sapphire is easily the best.

disconnects the cutter, reconnects the voice coil, and switches the set into the "pick-up" position. It now operates as a straight out gramophone, and the record may be "played back" immediately it has been cut, and the fine swathe removed from it.

Incidentally, this swathe is dangerous stuff, because it is most inflammable. Even a hot soldering iron will ignite it. When it is removed from the record, roll it into



This spindle and pulley is changed for microgroove cut in the recording unit. The standard type is simply lifted out after removing the check grub screw beneath the unit, and the microgroove spindle inserted instead.

a small ball between your hands and place it in a tin with a lid on it. Afterwards you can burn it in the back yard, and be thus certain it won't cause further trouble. Under no circumstances should you leave it lying about.

The switch referred to can be wired in place of the "gramo" switch, and has three positions—radio, record and playback. It's as simple as that.

COMPENSATION

Now, about that high note loss. The easiest way to compensate for this is to wire a condenser between the moving arm of the volume control and the "hot" end. This condenser bypasses the volume control altogether on high notes, and thus records them at a higher level than the lower ranges.

Its value will be determined by experiment, and in practice about .0002 will be about right. The best way to connect it is to provide a separate switch to bring in one of three values—.00005, .0001 and .0002. Such a switch allows the boost to be further applied to playback as well as to recording, and is often helpful. Or you could use a double section switch with enough contacts to connect a condenser of the right value permanently when recording and/or playing back. Just how far you go with this will depend on your own circumstances. We used the separate switch, which is obviously the most flexible.

Large sizes of condenser are not good, because they allow the boost to extend too far down the scale. Remember the system is essentially simple and effective, but don't try to make it do too much.

CUTTING LEVEL

It is possible by trial and error to judge the amount of cutting level by listening to the loud speaker, but a much better idea is to use a meter and rectifier which reads the actual level across the cutter. A little experiment will show you what meter reading corresponds with the safe average level, as well as a greater reading, representing peaks, beyond which overcutting and distortion will take place.

In our experimental work, we made a number of records, using the ear alone, but once having installed the meter, we found is invaluable. For an elaborate setup, such a meter is an essential.

An ordinary ex-disposals 0-5 ma. meter is quite OK, using either an ex-disposals full-wave rectifier, or, better still, a proper meter rectifier. The disposals type have a poor frequency response and may therefore be misleading.

THE advent of microgroove recording has almost revolutionised home recording. One inch of recording space will play nearly seven minutes, and about 2½ inches is available on a 12 inch record with good results. Up to 3 inches can be used with some deterioration at the centre. Thus you get 15 minutes instead of about 4 with a 78 rpm, and quality is just as good. More care is needed with the finer points, but that's only a matter of practise. Our first experiments with microgroove indicate that it will almost entirely supplant earlier methods for home recording. We'll have more to say about microgroove next month.

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Apart from longer playing time and saving in space and cost, Microgroove being cut at lower recording levels gives infinitely better reproduction. This is particularly noticeable in increased high frequencies with less distortion.

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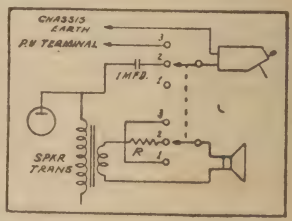
Your hobby can provide fun for all the family when you "cut" and "play" your own recordings with a BRS R-12-D unit. Recordings of your children, your favourite programme, musical items at parties, surprise recordings of friends, can all be produced with volume and quality equal to commercial discs. Easy to operate and easy to install, the BRS R-12-D unit will provide you with a hobby that all will admire and in which all can share.

EASY TO INSTALL

The installation of the R-12-D can be easily and cheaply effected. All you need are a few low - cost components and this simple circuit diagram.



SAPPHIRE STYLUS SHARPENING SERVICE

Byer Industries have now installed precision sapphire stylus sharpening equipment. You will save pounds by taking advantage of this quick expert service.

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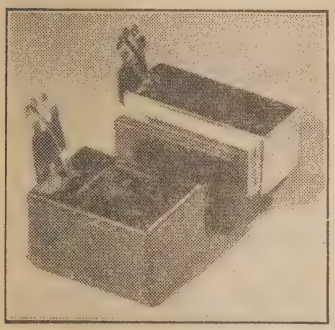
A 0-1 meter is just as good, if not better, but will require a larger series resistor to keep the needle within the scale limits when recording. The meter units aren't important—in all cases you must find the readings which represent recording limits, and make a note of them for reference.

What kind of set is best for recording? Undoubtedly, one which has a wide range tuner. The reason is mainly tied up again with frequency response. As almost everything in the chain tends to cut the highs, obviously a side-band cutting, selective set will be less preferable than one with a wider range.

The best we have used for the purpose is the FM receiver described some time ago. The FM station puts a strong signal almost anywhere metropolitan, and has a much wider frequency range than is extracted from the broadcast band by the normal superhet.



The Acos head is replaceable. Here are the microgroove and standard heads.

Our preference, therefore, would be an FM set, a wide band broadcast tuner such as a TRF type, or finally, a standard superhet.

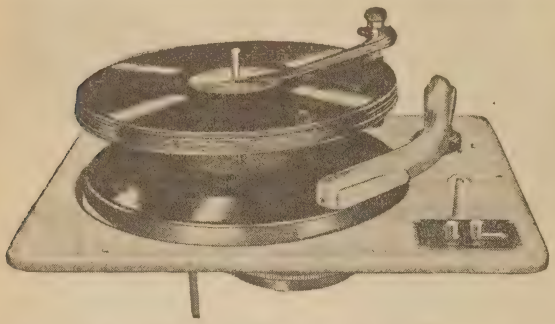
Don't get the idea, however, that the ordinary super is useless. To prove the point we took the original Little General—about the simplest mantel set—and fed its output diode into an amplifier. Results certainly weren't so bright and clean as with FM, but the use of the boost condenser made the records just about on a par with the set's original radio performance.

In fact, all the points in this article were extracted from many hours of test recording under the same conditions as you will be working when making your own records. If they worked for us, they will work for you. And we have made some mighty nice cuts!

An important point to remember is that no record can be better than the original source of signal. Frankly, some of the broadcast quality from local stations is at times so bad that it can only make bad records. The best of all are probably live artist broadcasts from the ABC, as recorded programmes cannot be better than the records themselves. Many of these are poor to begin with, so don't blame your recorder all the time if you get disappointments.

(Continued on Page 47)

two of the best . . .



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Don't just record for the sake of doing it, unless you just want to amuse yourself. But if you plan to make records of programmes you know in advance will be good, you'll get a real thrill to hear them come back to you in a creditable approximation of the original.

Before continuing with the story, a few points about mechanical processes and procedures.

Before making any cuts, you must adjust the cutting head weight to give the correct depth of cut. On the boss of the arm there is a screw adjustment for weight. Turn this for a very light pressure so that, when the quadrant is engaged, and the stylus lowered, it makes a light cut.

TEST CUTS

Proceed now to make a series of cuts with increased pressure — about 6 grooves at a time will do—until, when viewed under a magnifying glass, or by a good pair of eyes, the groove width is a fraction greater than the space left between each groove. The recommended ratio is 60 per cent groove and 40 per cent "land," as the uncut portion is called. It's better to be a little too light than too heavy, although 50-50 should be considered about the lightest cut. Too shallow a groove will not hold the playback stylus and will be noisy.

Do not use the cutter for playback. The makers say you can, and they are right. But apart from the necessity to set the thing up each time you change to playback, the design of a cutting head is just about everything that a playback head should not be.

About the best playback head we have used for this simpler type of work is the Acos GP20 crystal. It has high enough output to be used without pre-amplification, is light in weight, has practically no "talk-back" off the record, and has an interchangeable head for microgroove.

At all events, always use a separate pick-up for playback. Once you get the right adjustment for your cutter, it should "stay put," even when the cutter is changed for another of the same type.

STYLUS PRESSURE

The pressure for the sapphire isn't necessarily the same as that for the steel stylus. Always set up the cutter by working down from light cuts to heavier ones. Never "take a chance." If you cut through the acetate into the aluminium, you may damage the cutter, whether steel or sapphire.

It is essential that the recorder chassis be gently but firmly screwed to a firm support on all four sides. Do not use too much pressure or you may distort the casting. Poor mounting may cause rumbling, and allow small vibrations to build up often to quite high amplitudes, although the motor itself is a very smooth type.

Speed is changed by changing a drive wheel on the motor shaft. When not in use, always remove this pulley and park it on the peg provided for it. Constant pressure on the rubber rim drive will make a temporary bump in it, and eventually it may spoil the smoothness of the running.

Keep the quadrant and worm gear well lubricated with the special grease, or failing that, with vaseline. Smooth, even running here is essential to avoid unwanted noises from being transmitted to the recording arm.

See that the recorder is level—use a spirit level if you can. The idea is to set it up in a suitable spot, and once it is ok to leave it alone. If you keep changing adjustments, you can't expect to get consistent results.

Once again we would stress the importance of picking your material for recording. At first, you will be inclined to make cuts of all sort of programmes. After a while, you will become more selective, and realise that only the best are good enough to stand the acid test.

Some programmes are of sufficient interest to support a not-so-good performance, or a high scratch level, should it be from a record. But after you have finished convincing yourself about good material being necessary, and after you have proved that it's bad policy to record at too high a level, and so on, you should be able to reach a standard adjustment which will almost guarantee clean recording of almost anything.

Another tendency of the beginner is to overcut his records. It is an unfortunate fact that one badly overcut drum beat or piano chord can completely ruin an otherwise perfect disc, and unless a special amplifier with compression is used it is almost impossible to avoid an unexpected loud note to go a bit close to the mark occasionally. Therefore it is wise to always cut on a slightly lower average level than is absolutely necessary. The low noise level of good acetate discs makes this possible, and there is more latitude in this respect than you would imagine.

This is where the monitoring meter is so valuable. Without it you have only your ear to guide you, and it can be most misleading.

In our FM set, we added a pentode amplifier for microphone, using a 6AU6 mounted on a little sub-chassis tucked under the main chassis. A switch at the back change the audio input from the tuner to the coupling condenser of this pre-amplifier. Used with a crystal microphone, this gives ample gain for excellent direct recordings.

However, this is another subject which will be dealt with more fully in next month's issue.

FEATURING the new...

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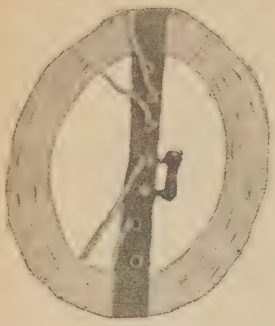

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Aerial Coil—iron clad	S.A.2	10/5
R.F. Coil—standard	S.R.F.1	9/6
R.F. Coil—iron clad	S.R.F.2	10/5
Oscillator Coils		9/6
I.F. Transformer—standard	S.I.F.1 & 2	15/1
I.F. Transformer—I/C	S.I.F.3 & 4	16/3

S.R.F. Coil

MINIATURE

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Midget Aerial Coil I/C	M.A.2	9/6
Midget R.F. Coil I/C	M.R.F.2	9/6
Midget Oscillator Coils	Shielded	9/6
Midget Oscillator Coils	on resistor	6/3
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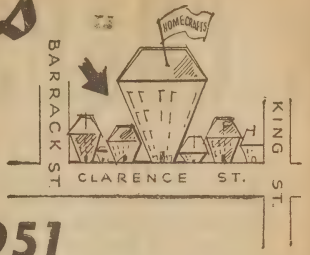

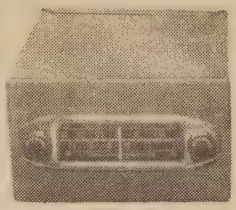

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A COURSE IN TELEVISION

PART 17—LINE AND FRAME PULSE

In the last issue, we outlined typical methods by which the rectangular timing pulses are separated from the composite video signal. Now comes the problem of splitting the timing pulses into the components which can trigger separately the line and frame oscillators.

FROM earlier discussion, the reader will be well aware that the composite signal provides, at the beginning of each line scan, a narrow timing pulse intended to keep the line oscillator in exact step with its counterpart at the transmitter. These pulses only are radiated during the period when one half-frame of picture information is being transmitted.

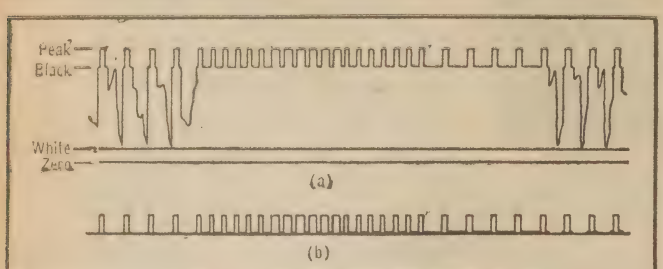


Figure 1. Illustrating portion of a typical television signal during the interval between frames. Sketch (b) shows the timing pulses, as delivered from the synch. separator.

For the purpose of explanation, however, our interest can centre mainly on the time interval which separates individual half-frames, when both horizontal and vertical timing pulses are sent and utilised.

We have already seen how the timing pulses are applied to the vision carrier, representing amplitude peaks with a negative modulation system and amplitude troughs with positive modulation. In both cases, the synch. pulses extend into the "infra-black" region so that, after detection and d-c restoration, the composite signal is essentially the same in both cases.

COMPOSITE SIGNAL

Figure 1a illustrates a typical composite signal containing the final lines for one half-frame, the vertical timing interval between frames, and the next couple of active lines.

Figure 1b shows how the timing pulses would appear at the output of the synch. separator stage—the picture information having been eliminated.

The pulses are shown in their idealised form, with vertical edges and perfectly flat tops. In practice, this ideal condition is never achieved at any stage, the pulses exhibiting a slight rise and fall time, with some rounding on the corners—characteristics which are the subject of tolerance limits at the transmitter.

However, disregarding such natural limitations for the time being, the synch. separator circuits deliver a series of timing pulses similar to those illustrated in figure 1b.

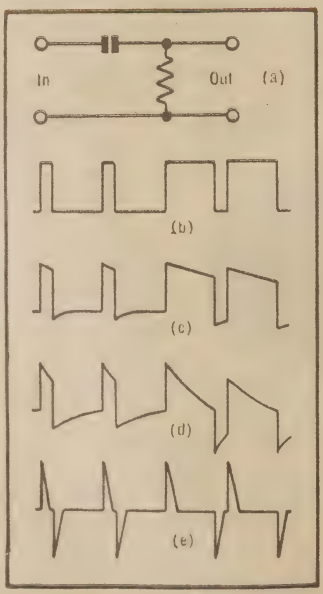


Figure 2. Illustrating a differentiator circuit (a) and its effect on the waveform (b) as the time constant is shortened. (e) is the required result, representing a very short time constant.

The pulses all have the same peak amplitude (thus avoiding extra demands on transmitter power), but they vary in duration, and therefore in total pulse energy. The problem is to translate the impulses into a form suitable for triggering quite independently the two oscillators.

Referring first to the horizontal (or line) oscillator, it requires to be maintained at the exact line repetition frequency, both during the build-up of a picture and during the interval when the vertical oscillator is returning the spot to the top left-hand corner ready for the next frame. If synchronism were to be lost during this interval, at least a portion of the picture would suffer.

Thus, the circuitry used to extract the line synchronising pulses must ignore the pulse duration and provide a regular and unbroken series of "pips."

The significant part of the pulse for this purpose is the leading edge. If a television waveform is plotted against time, it will be found that a series of leading edges are encountered at equally spaced intervals, corresponding to the line frequency. The ensuing pulse may be long or short, as required, or the signal may be modified in other ways, but the required "leading edge" is always there at the right moment.

REGULAR PULSES

Referring to figure 1 it will be noted that the leading edges of those pulses superimposed on the picture information do occur at perfectly regular intervals.

Immediately afterwards, there follows a brief "equalising" period equal to nine lines, but containing 18 pulses in all—six short, six long and six short. This is twice the normal pulse repetition rate, and it can be expected to produce twice the normal number of line synchronising "pips."

The reason for this change of pulse rate was explained in an earlier article. To repeat the matter in brief, an interlaced scanning system requires a fractional relationship between the frame and line frequencies. Thus, in 625-line system, one half-frame must occupy the same time interval as 312½ li

By doubling the line pulse rate at the end of each half-frame, it is possible to absorb the odd half-line without putting the line oscillator out of step. There is nothing new about this.

Properly adjusted any ordinary time base will trigger on impulses occurring near the beginning of its sweep and ignore any impulses received while the sweep is in progress. A common example of this is found in the ordinary oscillograph, where the sweep oscillator can be locked at any frequency which is a near sub-multiple of the waveform under inspection.

In a television receiver the line oscillator responds only to the alternative pulses during the "equalising" period, and it will be found that these alternative pulses provide the required leading edge at exactly the right time interval.

To get back to the main theme, however, it is normal to use a "differentiating" circuit to produce the line synchronising pips.

The "definition" is rather imposing at first encounter, but it refers essentially to a series resistance-capacitance network (figure 2a) with the output derived across the resistor. It is, in fact, an elementary high pass filter whose cut-off is determined by the values of L and C.

TIME CONSTANT

When dealing with pulses it is more convenient to think in terms of the time constant of such a combination rather than its cut-off frequency. For the sake of reference the time constant of an R/C circuit is the period required for the condenser to reach 63 per cent of any potential applied to it through the associated resistor.

Conversely, it is equal to the period required for the potential across the condenser to fall to 37 per cent of any initial value when discharging through the associated resistor.

Mathematically, the time constant in seconds is equal to the product of capacitance in microfarads and resistance in megohms.

A few simple diagrams will serve to illustrate the significance of time constant when dealing with pulsed waveforms.

Let's assume that a number of timing pulses (2b) are passed through the differentiating network of figure 2a and that the time constant of this network is kept relatively long. The pulses will be reproduced essentially in their original form except for a slope on the "horizontal" portions of the pulse and the gradual loss of the d-c component (figure 2c). This peculiarity of R/C circuits was the subject of an earlier article.

If, now, the time constant of the circuit is reduced drastically the pulses are immediately and severely distorted, as in figure 2d. The condenser passes the full transient value of the first pulse to the resistor, but even though the input remains at this high potential for an instant the condenser cannot maintain the potential across the resistor. Thus, the voltage across the resistor has reduced considerably by the time the reverse side of the pulse is encountered.

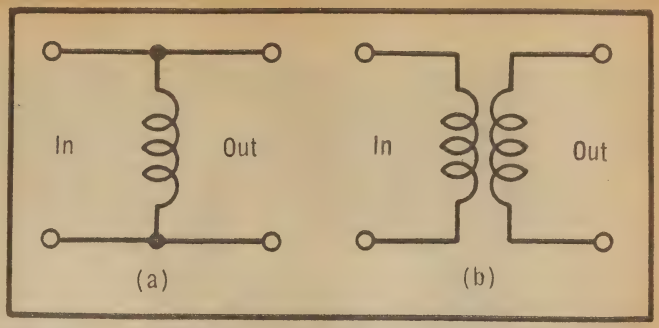


Figure 3. An alternative type of differentiator circuit uses a shunt inductor (a) or a double-wound transformer having a severely limited low frequency response.

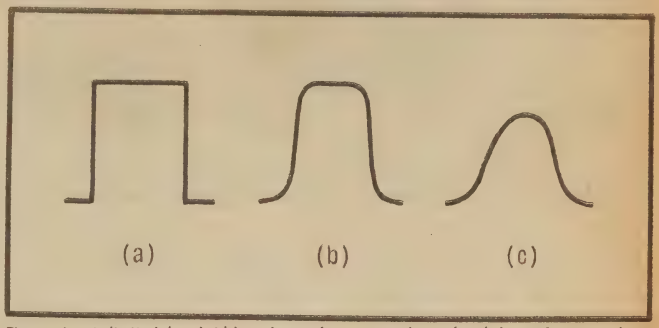


Figure 4. A limited bandwidth reduces the rectangular pulse (a) to the somewhat rounded form of (b), which further degenerates to (c) as the bandwidth is restricted still further.

NEGATIVE PIPS

This trailing edge actually carries the voltage across the resistor into the negative region and a period of discharge follows while the input voltage remains temporarily on the zero line.

On the longer pulses the voltage across the resistor has virtually disappeared before the trailing edge is encountered. Under these conditions the negative-going trailing edge carries the voltage across the resistor well into the negative region, so that the rectangular pulses are transformed into a roughly triangular shape.

If the process is carried still farther the time constant can be made comparable with the duration of the shortest pulses. When this occurs (figure 2e) the leading edges of all pulses are transformed into sharp positive-going spikes, while the trailing edges become negative-going spikes of similar magnitude.

The negative spikes have no significance in the operation of the time base, the positive-going spikes being the ones utilised for synchronisation. It follows that if the leading edges of the pulses are properly spaced, as is indeed the case, then the positive synchronising spikes will occur at exactly the right intervals, carrying no hint of the actual duration of the initiating pulses.

During the interval where the pulse rate is doubled for the equalising purposes, there are twice the usual number of positive spikes, but only the alternative ones will trigger the oscillator.

PULSE LENGTH

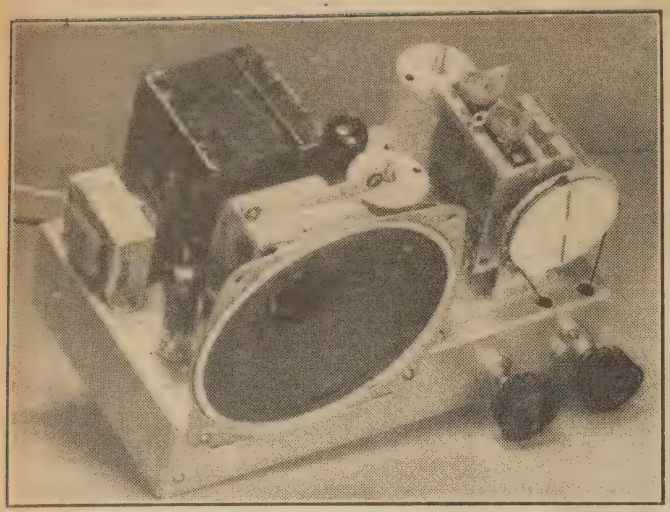
As a guide to the quantities involved, the actual duration of a line synchronising pulse varies from 10 microseconds with the British 405 line system to approximately half that figure with the American and Australian standards. If the "spikes" are to conform to the general shape suggested by figure 2e, the time constant of the differentiator circuit must obviously be substantially less than half the pulse width, giving figures of between 2.5 and about 1.5 for the two systems.

The network in British receivers consists commonly of a 50 pf condenser and a .05 meg resistor, somewhat lower values of one or both being required for the finer standards.

For the sake of reference it may be recorded that the line synchronising spikes can be separated by using a simple or coupled inductance, as indicated by figure 3.

The sudden application of a pulse will cause the generation of a counter-EMF in figure 3a, which will generate a sharp negative pulse. If the inductance is limited and the

(Continued on Page 95)



The chassis has been tailored to fit the standard "Little General" cabinet. The gang will probably require raising about ¾ inch to suit the normal cabinet cutout for the dial. Bolts ⅛ inch can be used to do this.

THE XMAS BOX MANTEL SET

Are there any new circuits? If not, at least we can still think up some new circuit applications. This little mantel set, for instance, might well start a fashion through its use of a hook-up we haven't seen anywhere. Its low cost and sheer performance provide a timely answer to the problem of designing an inexpensive mantel set which isn't just a rehash of past ideas.

WE can introduce our new baby in no better way than to relate its factual life story.

It began several weeks ago when we were facing up to the December issue. Quite naturally, we were looking for a Christmas feature, something new, different, something to beat the sales tax!

Out of it all came an idea for a miniature radiogram, along the lines of the original "Babygram" but brought up to date and adapted for a lightweight pickup.

The set was duly built up, following conventional layout practice, with a dial in the centre, a knob either side and nothing in its make-up that would cost real money.

SURPRISING PERFORMANCE

Then came the shock! When we finally put it on the air, that little set worked far better than we had ever hoped for. Indeed, the circuit had proved itself a "natural" for a simple mantel set. The radiogram version would have to wait till later!

The whole thing was therefore ripped to pieces and completely rebuilt as a mantel set—speaker on one side, dial on the other in the accepted tradition. In this form, it is simpler and cheaper than the "Little General" but streets ahead of the usual regenerative set.

But what's special about the circuit? That's a fair question.

NEW TUBES

The secret of its performance is bound up in two high-gain miniature tubes, a 6N8 which is used as a reflexed amplifier and a 6M5 high-slope output valve. A miniature 6X4 rectifier completes the valve complement.

The whole circuit is actually a very logical development from previous work with miniature tubes and with reflexing in simple superhets.

The incoming signal is fed to the primary of a standard commercial "Reinartz" coil, which is available on the market in several brands.

The grid and reaction windings are coupled to the 6N8 pentode in a way which gives it all the appearance of a regenerative detector but, in this case, appearances are deceptive—the valve is actually operating as a regenerative R.F. amplifier.

From the plate of this amplifier, the signal passes through a standard R.F. coil to a pair of diode plates which provide detection. From here on, the signal is pure audio.

In the normal way it would be fed straight to the output valve but, in this set, we have gone one better. The signal is fed back, instead, to the grid of the 6N8 pentode and an amplified version is picked up across the screen feed resistor. Thus, the grid-screen section of the tube becomes virtually a triode audio amplifier, providing a useful degree of gain before the signal is applied finally to the output valve.

DESIGN IN DETAIL

This will give you an idea how the receiver works but the design, taken in detail, bristles with interesting points for the student of circuitry. It may be well worthwhile to devote a few paragraphs to this aspect.

In the normal R.F. stage, the grid is connected directly to the top of the coil but, where reflexing is required, an input path must be provided for the audio signal. In a T.R.F. stage, series feed is impractical because the gang rotors need to be physically earthed and the bottom of the coil must either be earthed also or bypassed with a very large condenser to preserve tracking.

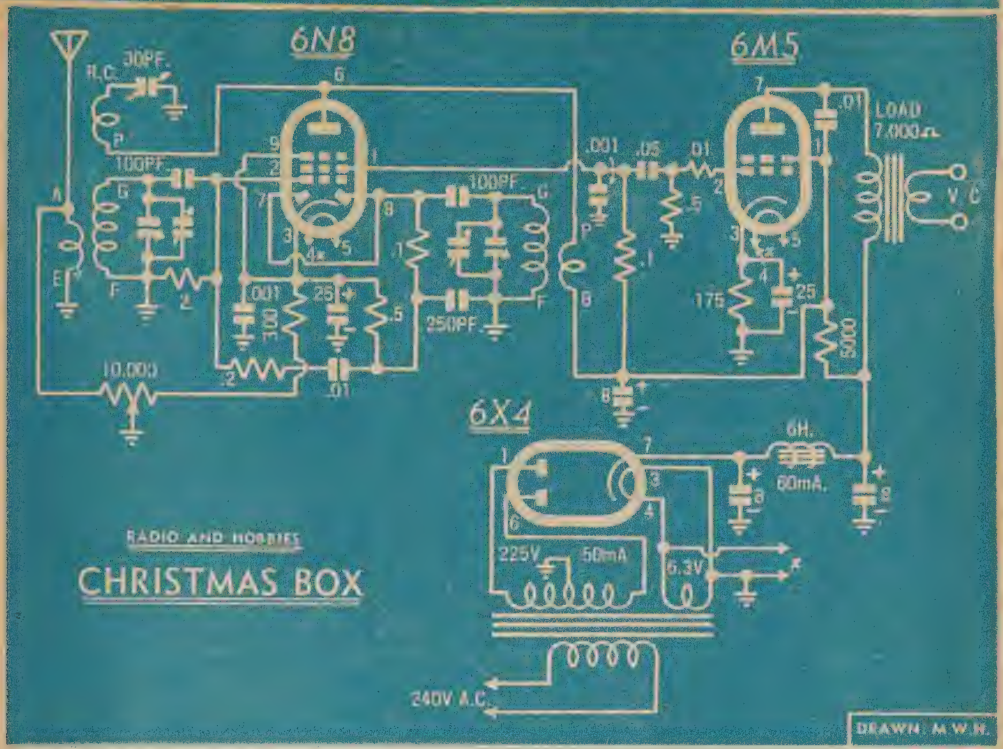
As a result, shunt feed must be provided for the audio signal and this accounts for the 100 pf. coupling condenser between grid and coil. The audio is applied through a 0.2 meg. resistor, while a 2.0 meg. resistor provides a d-c path from grid to ground.

In wiring this circuit, the condenser should be located right at the grid pin, likewise the two resistors. Any significant length of lead attached to the grid may induce a light, singing hum in the output, particularly if it happens to be close to a-c wiring.

REGENERATION

The plate circuit is essentially the same as for a regenerative detector except that, in this case, we have specified a simple compression trimmer for reaction control. The gain is normally quite high but a spot of fixed reaction is an aid to improved gain and selectivity, particularly at the high frequency end of the band.

CIRCUIT DIAGRAM OF THE XMAS BOX MANTEL



Only two valves, but there are virtually four distinct stages in this attractive receiver. See if you can pick them: (1) regenerative R.F. amplifier, (2) diode detector, (3) triode audio amplifier and (4) pentode output valve.

The general idea is to tune the receiver to the highest frequency station you are likely to want, then increase the trimmer capacitance until the stage approaches oscillation. After that, you can work on the normal gain control.

We are not seriously suggesting this as a country set, although, there is no reason why it should not be used in exactly the same way as other small regenerative receivers. In this case, the idea would be to bring the reaction control out as an additional knob, using a .0001 mfd. variable, keeping the reaction right "on the nose" in the usual way. However, that is really a side issue.

The R.F. coil is also a standard component and available in a number of brands.

Remembering our experience with the "Minivox" receiver, it is possible that improved gain would be obtained from one of the tapped-secondary R.F. coils, as used in the R & H "Karset." While this may be so, such coils are much less likely to be on hand and we were quite happy with the results from a more standard component.

Once again, in the diode detector, the same problem of series and shunt loading arises. In a superhet receiver, it is usual to connect the diode load network in series with the "cold" end of the tuned circuit and there is no difficulty about this, because the tuned circuit is a compact self-contained unit.

In a T.R.F. however, with one side of the tuning condenser earthed, shunt loading must be used—hence the 100 pf. coupling condenser to the diode and the 0.1 meg. resistor which prevents the audio network from shorting out the second tuned circuit.

The 0.1 meg. resistor is purely an isolating resistor, the 0.5 meg. resistor constituting the active diode load. It naturally returns direct to cathode to avoid the possible application of bias to the diode detector.

Once again, the leads to the diode elements should be kept short both as a precaution against hum and to avoid unnecessary shunting of the tuned circuit.

The screen reflexing idea has already been covered in earlier issues

PARTS LIST

1 Cabinet, "Little General" or similar.
1 Chassis 8½" x 5" x 2".
1 Power Transformer, 225V 50mA. and 6.3V. 3A.
1 Fliter Choke, 7H. 50 mA.
1 Speaker, 5" permag.
1 Tuning Condenser, 2 gang midget.
1 Dial, complete with cord, drum, spindle etc.
1 Reinartz Coil.
1 R.F. Coil.
3 Miniature Sockets, (2 9-pin, 1 7-pin).
1 Carbon Potentiometer, 10,000 ohm.
3 Trimmers, 30 pf.

CONDENSERS

2 25 mfd. 40 volt.
3 8 mfd. 525 volt.
1 .05 mfd. 400 volt.
2 .01 mfd. 400 volt.
2 .001 mfd. mica.
1 250 pf mica.
2 100 pf. mica.

RESISTORS

1 2.0 meg. ½ watt.
2 .5 meg. ½ watt.
1 .2 meg. ½ watt.
2 .1 meg. ½ watt.
1 5,000 ohm 1 watt.
11 300 ohm ½ watt.
1 175 ohm 3 watt ww.

SUNDRIES

Hook-up wire, tinned-copper wire, 4 3-lug tag strips, spaghetti, power flex, power plug, 3 7/16" rubber grommets, ⅛" nuts and bolts, ⅛" washers, 2 knobs etc.

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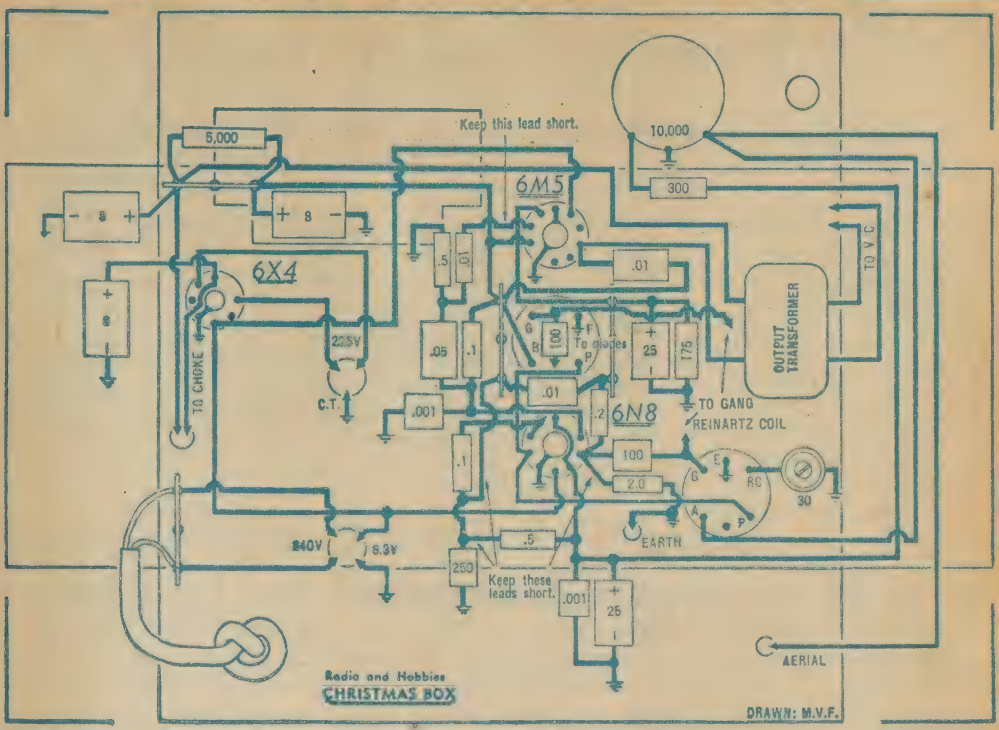


You should have little trouble in wiring up if you take this dia gram as a guide.

but it is a particularly effective arrangement. The normal 0.1 meg. screen feed resistor is quite suitable as an audio load and it is merely necessary to drop the by-pass value from the usual 0.1 mfd. to something around .001 mfd. It is still useful for R.F. but allows audio voltages to be developed across the resistor.

The output stage is quite conventional, the only possible difference being the use of a suppression resistor at the 6M5 grid pin as a precaution against instability.

GAIN CONTROL

The matter of gain control gave us considerable food for thought and experiment.

With a diode detector, it is obviously possible to apply A.V.C. to the 6N8, the control being effective both on the R.F. and the audio channel.

On weak stations and with a short aerial, the idea works fine, but it breaks down badly under other conditions. With large input to the grid a substantial control voltage is developed, sure enough, but it turns the 6N8 into a pretty fair anode-bend detector. A considerable audio singal is therefore fed through to the 6M5, quite irrespective of the diode and manipulation of the volume control gives rise to a vicious "minimum volume" effect.

There is another serious objection, too, in that only one tuned circuit is there to select the spurious signal, so that selectivity goes to the pack. The obvious requirement, therefore, is to exercise more rigid control over the input signal and to keep the set working as originally intended.

In the final arrangement, we have discarded the A.V.C. altogether and substituted a manual bias control in the cathode circuit of the 6N8. In this position, it controls the gain both of the R.F. and audio channels and is particularly smooth in its operation.

The moving arm of the potentiometer is conveniently earthed and the free end is connected to the aerial. Ideally, the aerial wire should run straight to the potentiometer and thence to the coil. Retarding the control increases the bias on the 6N8 but simultaneously shunts the aerial circuit, offering an immediate protection against excessively strong input signals.

REGENERATION

There is another important point, in that it also limits the reaction effect. Therefore, should the reaction control inadvertently be screwed in too far, or should it be affected by aerial length, the oscillation can be stopped by simply retarding the volume control. The set should not be operated deliberately in this fashion, but it is a handy precaution against maladjustment.

Finally, there is the power supply. We actually began by omitting the filter choke altogether and relied on a large condenser for filtering. This method is used by some commercial manufacturers, but, unless one is prepared to limit the operating conditions of the output valve and also to use condensers of the full stated capacitance, a high hum level can result.

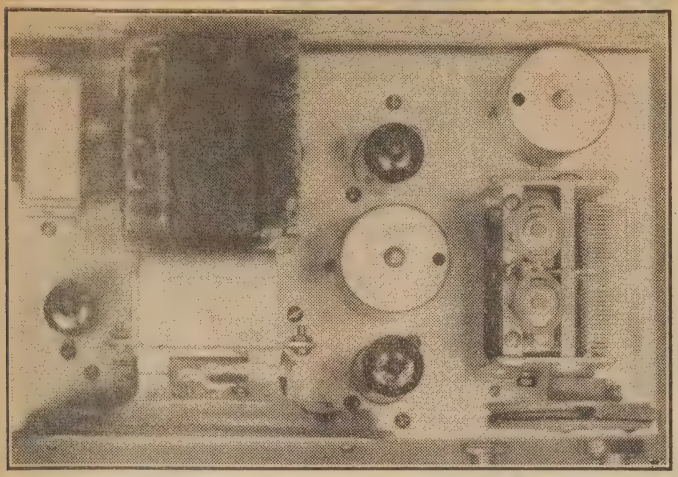
LOW HUM

Ultimately we went to the other extreme, endeavoring to get thet hum so low that it would never bother anyone, even using the set under the most intimate conditions. Accordingly, we have specified a small choke and some common decoupling for the screen of the 6M5 and the supply to the 6N8.

The hum, with this arrangement, is very low but it can be made absolutely nil by stepping up the value of the first filter condenser to 16 mfd. Please yourself on this point.

One thing should be watched in particular, namely, the position of the loudspeaker output transformer. If this is mounted, either on the speaker or the chassis, so that its field is parallel to the power transformer field, hum trouble may be

VIEW ABOVE THE SET CHASSIS



The valve near the speaker is the output pentode, the one behind it is the RF valve. The rectifier is at the left.

experienced. It can be distinguished by the fact that it appears immediately after the set is switched on and before the rectifier has a chance to warm up.

In the effort to get the hum to zero, we mounted the transformer right away from the power transformer, extending the leads to the voice coil.

All this discussion may give the impression that the set is a complicated one, but such is not the case. The circuitry is a little different and warrants discussion, but there the matter ends. Put the set together in line with the diagrams and it cannot fail to work.

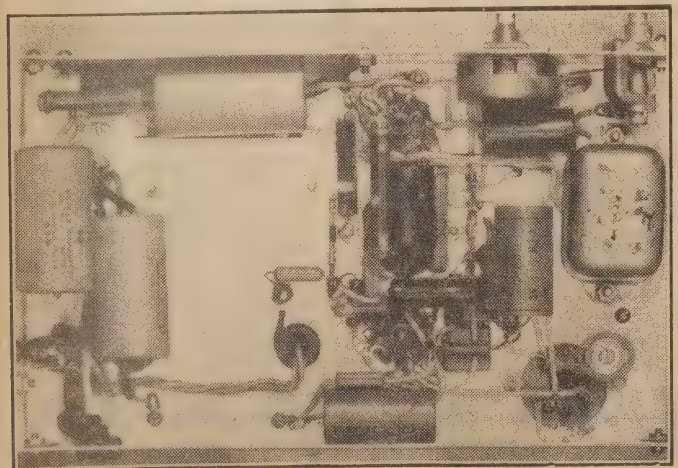
Of course, in all fairness, it does not mean that sets like the "Little General" have now been rendered obsolete. The superhet circuit gives more gain and selectivity as a matter of course, and you don't have to worry about such things as location and aerial length.

In this case, both are significant. No TRF is a good proposition if you live in the shadow of a transmitting mast and want to hear other stations much further away and much weaker.

However, this set will do a good job on the local stations in most areas, provided you take a few minutes off to experiment with the length of aerial.

Your "Reinartz" coil will probably have connections marked "long aerial" and "short aerial." Generally speaking, the "long aerial" connection will be the better, since it ensures higher selectivity in the first tuned circuit.

In the laboratory we used a long outdoor aerial but "shortened" it electrically by connecting a .0001 mfd.



Placement of speaker transformer may be critical. Keep it well away from the power supply.

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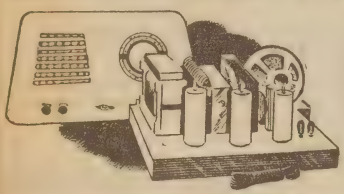

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mica condenser in series with the lead-in.

In the suburbs we found that about 10 feet of wire on the same terminal gave the best balance between signal strength and selectivity. Under these conditions all the locals could be tuned cleanly with volume to spare.

In constructing the set, we have made no special effort to achieve miniature construction, although the overall size is not large. The chief purpose in following this line of attack was to obviate the problems which really miniature construction poses for the novice constructor.

CONSTRUCTION POINTS

The chassis measures 8½" x 5" x 2" overall and the placement of the gang and the speaker will allow it to fit nicely into any one of the "Little General" series of cabinets. These have undergone "unofficial" modification during the past few years and some appear to be a lot taller than others. If using one of these cabinets, therefore, the idea is to mount the gang on long bolts, raising or lowering it as necessary to bring the dial opposite the cut-out in front of the cabinet. It would be wise to check on the knob positions also.

It is always wise to check on points like this, when building a new receiver, since it is a lot harder to make changes after the wiring has been completed than when working on a bare chassis.

Check also the position of the speaker and transformer. Five-inch speakers are available in several brands, all with slightly differing dimensions. Mount the speaker in place temporarily and, if necessary, drill extra holes or amend the cut-out to suit.

Some speakers come with the transformer attached, others are sold separately. If attached to the speaker, make sure that the body of the transformer will not foul the top of the cabinet. If it does, you may have to lower the speaker on the chassis or remove the transformer altogether for separate mounting.

CHECK CHASSIS

We have already mentioned the matter of hum due to the proximity of the output and power transformers. In the chassis you will ultimately buy, we plan to turn the power transformer round to alleviate this problem to some extent. It seemed hardly worthwhile making the change in the prototype chassis, but watch the point when you are checking layout and assembly.

When you have satisfied yourself on these initial points, go ahead and mount the major components, using lock washers under the nuts and tightening them firmly but not with enough pressure to strip the threads. Check the position of the coils so that the lugs, so far as possible, fall into the same positions as indicated on the underneath wiring diagrams.

Some coils have the connections directly marked, others use a code system, with the appropriate connections outlined on the carton or the coil can itself.

There does not appear to be any iversal standard method of iden-ying the transformer connections thout the aid of test instruments, that a cerain amount of initiative ay be needed to separate the 240-lt primary leads and the 225-volt condary leads. The 6.3 volt fila-ent leads are of much heavier uge and present no problem.

Usually the primary and high volt-e secondary leads are brought out separate sides of the bobbin and ten a better grade or two layers of aghetti are used for insulating the imary connection. There will prob-ly be one remaining lead, which brought out without any special sulation. This is the electrostatic ield between the windings, and ould be earthed.

SSEMBLY

Assembly of the set should begin th the mounting of all the major mponents excluding the speaker. ave the latter until just before u are ready to switch on the power it is very easy to push a screw-iver through the paper cone even you are very careful.

It will make things easier if, be-re mounting the tuning gang and eaker transformer, you attach the quired extension leads. Solder a ngth of hook-up wire about 4in ng to each of the gang stator plate nnections and extend the second-y leads of the transformer to a ngth of about 10in., assuming, of urse, that you do not intend to ount it on the speaker itself.

Do not forget to use rubber grom-ets in the holes for the power nsformer leads, and also the power rd lead. The latter is most im-rtant.

In mounting the coils and valve ckets, take care that they are in e most favorable position for short ads. The grid connection of the nartz coil should be as close as ssible to the 6N8 socket, and we ve arranged the mounting holes that the grid pin can be placed rectly opposite the coil.

IRING

Similarly, orientate the RF coil that the plate connection is as ort as possible. The exact place-ent of the output valve socket is rhaps not so important, but keep e grid wiring as direct as pos-le. Complete the first stage of e assembly by mounting the po-tiometer, dial spindle and filter oke.

Since the set employs a reflexed plifier, there are several more all components than would be nd in a three valve "straight" set, d it is not always possible to ke the junctions of the various mponents at a valve socket. How-er, it is a simple matter to install couple of tag strips and, apart m providing tie points, they help prevent a crowding of components ound the valve sockets.

By the way, do not be tempted use spare socket connections as points since some valve pins rked "no connection," are used to pport part of the internal struc-ture of the valve. It is essential to earth the centre metal spigot of all three sockets.

If you are not accustomed to following schematic circuits, the detailed wiring diagram which we have prepared will be of assistance to you. It shows all small components under the chassis and every connection in the set. Since the diagram cannot be made three dimensional some of the components must necessarily appear in slightly different positions, but if you compare the wiring diagram and the underneath photograph, you should have no difficulty in producing a set with all components mounted as firmly and as neatly as in the original.

EARTH RETURNS

If you are using a sprayed steel chassis it is not a good idea to rely on the chassis for earth returns. After bolting solder lugs at strategic points around the chassis, connect them up with a length of tinned copper wire, so that, if one does not happen to make positive contact, it is not of any great importance.

Before mounting any of the small components connect the filament wires, both the primary and secondary transformer wires, speaker voice coil leads, &c., the object being to have all such wiring close to the chassis and under resistors and condensers, largely in the interests of neatness.

Certain leads associated with the grid circuit of the 6N8 and the diode circuit should be as short as possible otherwise a high-pitched hum will appear in the output. If you install the condenser and two resistors in the grid circuit and the condenser and resistor to the diodes before any of the other small components, it is quite easy to reduce them to ¼in or so in length. We have indicated the critical leads on the under chassis diagram.

TESTING

Having completed the wiring you must proceed to the nerve racking business of switching the set on for the first time.

Reassure yourself that the mains leads are in order and that they are not likely to be disturbed by a reasonable strain on the power cord. To this end, it is a good idea to tie a knot on the inside of the chassis.

Then, without the 6X4 in place, switch on the power and if everything is in order the heaters of the 6N8 and 6M5 will heat up to a dull red in about 30 seconds. Switch the power off and then on again with the 6X4 in place, at the same time carefully watching the plates of the latter. If there is a persistent blue glow between the plates and the filament or any indication of an arc inside the valve, switch off the power and look for a short in the wiring or, failing that, a faulty electrolytic condenser.

The chances are 99 to 100 that everything will be in order the first time you switch on, provided you have been careful with the wiring, but we mention the above in case you happen to be the odd unlucky one.

Regardless of the setting of the various trimmers and slugs it should now be possible to receive something with a reasonable aerial. Unless you are in a poor location and have a poor aerial you can take it for granted that there is something wrong with the set if it fails to bring in a signal of some sort.

Having made the set operate it remains to align it for best performance. There is no need for a signal generator or other elaborate equipment. As a matter of fact, there is a very good reason why the set should be aligned with the aid of broadcast stations and connected to the aerial with which it will be used permanently. We do not mean to infer that the set has to be realigned every time it is used with a different aerial. Actually the alignment is not very critical since the second tuned circuit which is loaded by the diode detector tunes relatively broadly.

LINING UP

Tune to the highest frequency station you can hear (condenser near open) and adjust the RF trimmer for maximum volume. Then, tune in a station toward the low frequency end of the band and adjust the RF coil slug for maximum volume. Loosen the grub screw holding the dial drum to the condenser spindle and rotate the drum until the station corresponds with the dial marking.

You will have to slip the set in and out of its cabinet a couple of times with the dial mechanism we have suggested. Retune the set to the highest frequency station and adjust the aerial trimmer so that the station falls in its correct position, at the same time keeping the RF trimmer adjusted for maximum volume.

REACTION

Until now, the reaction condenser should have been left at almost minimum capacity. It should now be adjusted until it is almost possible to make the set oscillate on the high frequency station with the volume control fully advanced. This completes the alignment procedure but, if you are fussy, you can repeat it from the beginning, as the setting of the reaction condenser does have a slight effect on the alignment of the first circuit.

Note that the core of the aerial coil is not touched during the entire procedure. If the set is aligned at the ends of the band as suggested, all stations should fall on their correct calibrations provided the dial and condenser are designed to work together.

All that remains to complete the project is to screw the chassis firmly in its cabinet, when you will have a really "natty" little set which will give thousands of hours of entertainment from your favorite stations. And, you have the satisfaction of knowing that it only cost about half the price of a small commercial mantel set.

All cyclones, tornadoes and waterspouts that originate at cloud level turn clockwise in the Southern Hemisphere and counter-clockwise in the Northern Hemisphere.

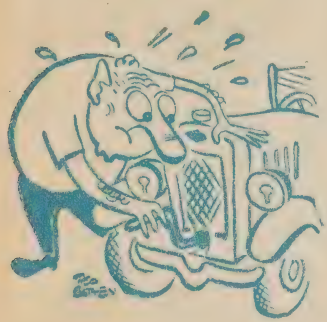
Here's your answer, Tom!

Tom hasn't been able to sleep for weeks, puzzling over a variety of technical questions. He thinks he has some of the answers but can't be quite sure. Here's hoping that a few simple explanations will put things right.

THE first question is an examination classic and you shouldn't have any trouble, Tom, in obtaining the story in as much detail as you want from any radio textbook. Just now we'll content ourselves by giving you the general idea.

How does an accumulator store up electricity and what rules govern its output current and voltage?

The simple point of the matter is,



Tom, that a storage battery does not store electricity at all. It would be more correct to say that it stores chemical energy.

A variety of storage batteries have been devised, but the most popular is the ordinary lead-acid accumulator as used in cars and radio receivers. Even though its chemical action may not be well known, the results of a "flat" battery have been experienced at some time or other by most motorists.

NEW BATTERY

When you buy it new a lead-acid accumulator has two sets of lead plates in each cell, one set being heavily coated with lead peroxide. The cells are filled (or need to be filled) with sulphuric acid of a certain specific gravity, as measured by a hydrometer.

When the terminals of a cell are joined by an external electrical circuit current flows through the circuit, being produced by a chemical action which is going on inside the cell. This chemical action transforms both the lead and the lead peroxide plate to lead sulphate. At the same time, also, the acid is rendered weaker by the process, being reduced partly to water.

Sooner or later the chemical action is slowed up to such an extent that little current will flow through the external circuit and the battery is then said to be "flat."

Charging the battery reverses the chemical process, restores the plates to lead and lead peroxide, injects the "sulphate" back into the acid (let's put it that way) and raises the acid to normal strength. The cell is then ready to deliver current again.

The point is, Tom, that the charging process has not actually inserted electrons into the battery. It has merely effected a chemical change in the cell and restored a condition which allows it to deliver current.

The terminal voltage of an accumulator depends on the number of cells it contains. A single cell has a nominal voltage of 2.0, so that three are required in series to make up 6 volts. "Series" means that the positive of the first cell is connected to the negative of the next, and so on.

CONNECTORS

In a complete commercial accumulator, like the one in your car, these series connections are effected with heavy lead bars, which the maker generally "decorates" with his trade mark or something.

The current rating of an accumulator, or the maximum number of amps it will deliver, depends on the size and the number of plates in each cell. The larger the plate area the more widespread will be the chemical action and the more current will be obtained.

Accumulators are rated to have a "capacity" of so many ampere-hours, which means, ideally, that the accumulator will deliver, say, 10 amps for 10 hours; if it is a 100 amp-hour type, or 5 amps for 20 hours, and so on. It is not wise to charge or discharge an accumulator for any length of time at a rate exceeding one-tenth of its ampere-hour capacity.

STARTER CURRENT

I have heard it said that a car starter may draw 100 amps or so, but this seems absurd. Ohm's law would suggest that the resistance in the battery and the starter would have to be no more than one-sixth of an ohm. Who's crazy?

No one Tom. Not having any degrees in automotive engineering, we can't say exactly what the usual maximum and minimum limits of starter current are for the various cars. However, your suggestion of 100-odd amps is not at all unlikely. It's probably a good deal more on some big cars with new batteries, new wiring and stiff motors.

It's obvious that a lot of power is required, because a good starter will spin a motor easily that you can hardly budge with the starting handle. All that takes horse-power and electrical amps to produce it.

Starting current never shows on the ammeter because the starter wiring generally runs straight from the battery terminals to the starter and switch—the latter being a rather imposing device or a relay, intended to carry amps and amps—and amps! The modest little ammeter only reads the current flowing through the generator circuits, the lights, ignition and other sundries.

As for the resistance in circuit, well it must only be a fraction of an ohm—hence the big switch contacts and the half-inch cable. There aren't many turns of wire inside the starter, either, and a good accumulator won't show much resistance. So there you are, Tom.

OVERLOADING

What are the causes, results and effects of overloading?

Were we to keep to the auto theme, Tom, your rather open question would give plenty of scope for our "corny" sense of humor.

In some cases overloading makes

it necessary for passengers to cram in together, even sit on one another's knees. This gives young swains like yourself a marvellous opportunity to get to know the girl better. After all, she can hardly remain aloof, while sitting on your knee!

We take it, however, that your question has a radio rather than an automotive interest. In this case, overloading usually refers to the audio system, and in particular the output valve. It happens this way:

Any given output valve, operating under specific conditions of bias, plate voltage, load &c., will deliver a certain maximum power output to the speaker. In the case of a 6V6 it might be 4.5 watts. With a battery tube, it may be one tenth or one twentieth of this figure—or even less!

To make it deliver this power, it has to be excited by a certain grid driving voltage—it might be anything from 1 to 50 volts, depending on the type of output valve and its operating conditions.

WEAK SIGNALS

Now a good modern receiver has plenty of amplification and it might be able to drive the output valve fully with an input signal to the aerial of a few millionths of a volt. That's very handy on occasions, when you want to listen to some distant station.

But local stations can produce a lot more signal than this in the aerial and the set could feed to the last valve many times the signal necessary to drive it to full output. If you turn the gain up so that it does this, the last valve "overloads." All the regular waveforms in the signal are flattened off, because the valve's plate current can't vary over wide enough limits to follow them.

The sound gets rough and raspy at first, then downright unpleasant, as the overload effect increases. If you keep turning the gain up, the output can get so distorted that it may be completely unintelligible.

In other words, if a valve can deliver half a watt of power under certain conditions, no amount of extra drive will produce more power. It only causes distortion. If you want more power, you must choose other operating conditions or another type of valve altogether, according to what the valve manual says.

OTHER CIRCUITS

Of course, overloading can affect more things than the output valve, although that is usually the point for overload to show up first. Given enough input signal and you can overload one of the earlier stages in a set, as well, or, if the speaker is too small for the job, you can overload that.

The result is usually the same — severe distortion!

As for the results—they can range from murder on the part of your neighbors to the more simple circumstance of a broken home. Actually the degree of overload which one might tolerate is not likely to cause trouble in an electrical circuit, although it is just possible. Overloading a speaker, however, will ultimately ruin it because of mechanical stresses on the cone, the suspension and the voice coil.

How long should an aerial be, and is there any benefit in using a lot of separate wires, as they did in the early days?

In answering this one, Tom, let's assume that you're not worrying about special things like transmitters, communication sets and so on.

You just have an ordinary little small set and you want to get good all-round results.

Okay, then go for an outdoor aerial about 50 feet long and 30 feet high with a fairly direct lead-in to the set. A larger aerial may bring in a spot of extra signal, but it's generally rather hard to arrange unless you live amongst the tall trees back-o-beyond. If you can't quite manage those figures, go as close to them as you can.

And don't forget a good earth connection, made either to the water main or to a length of pipe driven deeply into moist soil.

The gauge or wire is not very important, Tom, and the various types of "cage" aerial are of doubtful value. We remember seeing an article in an English journal written by someone who had tried them all out —complete with signal meters and so on.

AERIAL LENGTH

According to this learned gentleman, it didn't matter much for receiving whether you had one strand or fifty strands in your aerial, and he even got quite good results from one using resistance wire. Height and length were the important factors in all cases. The gauge of wire and so on was important mainly from the point of view of strength.

Of course, a big aerial may bring interference troubles with small sets, so much signal being fed in from nearby stations that the little fellows can't separate them. The The answer to this one is simply to connect a small condenser in series with the aerial lead-in wire and set it for the best results. Somewhere round .001 mfd. is usually effective, but a variable condenser will give you full control over the signal input and apparent selectivity.

We remember the efforts of another learned gentleman in the aforesaid journal, who demonstrated that it was better to use a big aerial lightly coupled to a set than a small aerial tightly coupled.

Should one use a small speaker with a small set? It seems to me that a big speaker would be hard to drive.

We probably can't blame you for getting the wrong impression, Tom, because it certainly does look that way at first glance.

But here's the point: Big speakers generally have bigger and heavier magnets and a stronger magnetic field around the voice coil. Their cones might be somewhat heavier and harder to move, but the difference isn't enough to offset the advantage of the big magnet. Consequently, when a certain amount of power is fed to the voice coil of a big speaker, there is every chance that it will make more noise than a little one.

If you have any doubts of this score, Tom, try feeding a portable set into a 12-inch speaker instead of

(Continued on Page 100)

Let's Buy An Argument

I now feel at one with the ancient writer who marvelled as his countrymen "swallowed a camel but strained at a gnat." You can kick a circuit as hard as you like, insult the ordinary listener and ridicule his pet ideas — all without raising too much fuss. But that parting reference to theory and practice has landed me in more arguments than I bargained for.

by W. N. Williams

MIND you, I don't take back one word of the original statement and no one has ever looked like disproving it. However, the fantastic feature of many letters has been that, having agreed that theory and practice are expressions of the same thing, the writers then try vainly to prove otherwise.

As if they possibly could! Every example which "demonstrates" a difference between the two, also demonstrates that the writer has missed out in his practical observation or his application of theory—generally the latter.

WHAT IS THEORY ?

The real source of the confusion is our misuse of the word "theory." In its elementary sense, it is purely a possible explanation of some natural phenomenon. Later it may be proved and accepted as the basis of a whole science but it is still "theory."

As used by the man in the street, it doesn't mean either of these things. It merely describes his impression of book-learning, tables, figures, graphs, charts, especially as interpreted by technical windbags, or laboratory high-brows.

Both are an equal menace. In a "QSO", recently, I heard an amateur give a long dissitation about some pet aerial system fed with a "flat" line—"no standing waves, no feeder radiation" and so on, ad lib. As an afterthought, he added a few pointers about trimming the line to make the transmitter load properly! Now I ask you?

One essential feature of a flat line is that its length is non-critical and the final reference proved quite conclusively (a) that the line wasn't flat and (b) that the would-be theorist didn't even know the meaning of his own terms. We've all probably committed the same offence at some time or other but it's no wonder if that kind of theory disagrees with practice.

On the other hand, I remember a bright young graduate, some years ago, who joined a small radio factory as an engineer. He certainly knew his theory and proceeded to design a really "hot" battery set, using a mixture of 2.0 volt and 6.3 volt tubes. The set flopped because the filament current was much too high.

ADDLED RADIO

His next effort was a masterpiece of economy but a hundred miles in a goods trains "addled" the inside of the notoriously unreliable tubes.

A few weeks in the country, meeting these problems first hand, would have brought his book-learning into perspective. He lacked, not "practice", but experience.

Letters of comment have come from places as widely separated as New Zealand and Western Australia.

Mr. H. R. Cox, of Cobden, New Zealand, has a very liberal outlook on amplifier requirements. Says Mr. Cox:

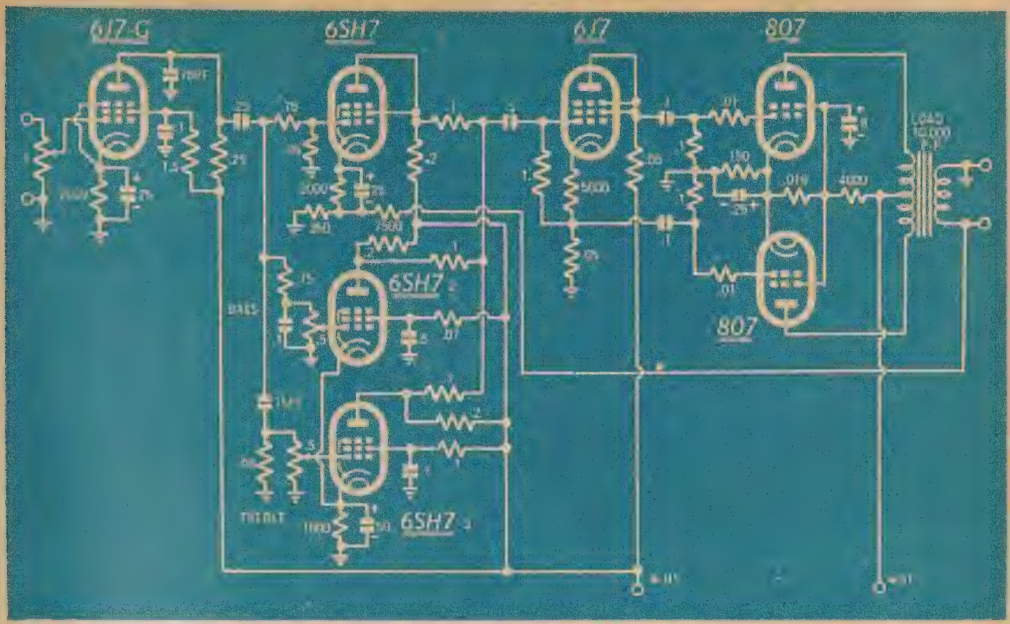
"The aim is to build an amplifier which will sound tops to the builder, NOT necessarily to his friends, for I will bet my bottom dollar that there'll be a difference of opinion.

"Here is an instance: 12" Celestion speaker on open baffle, triode amplifier and old type magnetic pickup; reproduction marvellous. Great bass and clean treble, but high fidelity? Bunkum!

"Another example: Amplifier using KT61 ex. R&H, Jan. issue. Nice clean output. Rola 12-0 speaker mounted in heavy open-backed cabinet; pickup, a Garrard hi-fi.

"My own amplifier uses 6L6's tetrodes, good quality output transformer, Goodman's Axiom 12 in vented enclosure—results excellent using modified HMV pickup."

Mr. Cox goes on to tell how he re-wired the KT-61 amplifier as a triode job and thought he noticed an immediate improvement. But the same changes in the 6L6 outfit made



The type of circuit favoured by one of our argumentative readers. It was voted as better than the Williamson. Actually the tone controls would provide compensation for pickup characteristics etc. and give better immediate balance. Apply the same compensation to the Williamson and the advantage would disappear.

not the slightest difference. Rightly or wrongly he concludes:

". . . tetrodes with feedback are as good as one can wish for and the triode enthusiast is perhaps a psychological specimen wrapped up in a little world of his own"

Mr. Cox contributes this final thought:

"I suggest readers build a reflex baffle of brick, perhaps. Too many baffles are built without due regard to the necessity for mounting the speaker in an enclosure having absolutely no resonance. The improvement is most marked . . ."

BASS RESPONSE

As worded, the contention is fundamentally wrong but I think I know what the correspondent has in mind. The vented enclosure is in fact, a resonant device, as also are folded horns and many other baffles. The whole idea in their design is so to control the air column resonance that it either cancels the cone resonance or tunes lower down in the spectrum, according to the effect being sought.

What really upsets the proverbial apple-cart is a resonance in the wooden side panels, which is likely to occur anywhere from 100 cycles up—precisely where it's not wanted.

Mr. Mantack of Western Australia contributes a circuit which amplifier enthusiasts will want to pore over. Says Mr. Mantack:

"Any good push-pull amplifier contains little distortion but what I believe most people look for is the amount and quality of bass and the degree of high note produced. With this in mind I set about designing a push-pull 807 amplifier with variable volume, not tone, controls.

"A friend built up one of those triode-connected amplifiers and I built the circuit enclosed with the variable bass and treble volume. Using the same speaker system and pickup, we both agreed that the circuit enclosed was superior.

"Considerable filtering is used on the H.T. supply and particular attention was paid to the screening of the grid and plate leads to prevent hum."

Mr. Mantack's circuit follows along lines suggested by many American constructors but it is a mistake to draw any special inference from the bass and treble controls. Though they operate in a rather unusual fashion, they are still tone controls in every sense of the term and the same arguments for and against.

DISTORTION IMPORTANT

I agree that frequency response is the first and most obvious basis on which an amplifier is judged, particularly if well designed and operating into an ordinary speaker system. That is why, a couple of months back, I suggested that a good variable tone compensating system, connected ahead of most amplifiers, would work wonders.

But, when one goes beyond this and gets into the realm of really wide range high fidelity equipment, distortion cannot be dismissed so easily. It's a pretty safe rule that the wider the range, the lower must be the distortion, or the listener gets very annoyed. All of which brings us to a little more original "nattering."

Over the past three issues, we've made some caustic remarks about the performance of record, pickups and speakers and emphasised the way they limit our best efforts with circuitry.

TOUGH PROBLEM

That is perfectly true but don't make the mistake of thinking that the gentry responsible for their design are lacking in technical know-how. The point of the matter is that they have the heavy end of the stick.

The going gets really tough when you have to mate these impulses with mechanical movement and that's the problem which faces the designer of any one of the accursed devices.

Getting down to fundamentals, the whole business of sound conversion and production strikes me as "messy." Even mother nature gets into strife with the tissues and couplings which convert air vibrations into electro-chemical impulses.

In fact, I could go farther and suggest that the whole idea of sound-communication is a primitive expedient.

Our basic wants and emotions, our inspirations and deliberations, arise initially as electro-chemical impulses, ready to be transmitted

Periscopic Prisms

A perfectly ground prism originally used in tanks for periscopic sighting. Two of these prisms will give full periscopic effect; one prism will give upward sighting. Original cost to Army, £6/15/-.
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Pure wool, soft and woolly, in pleasingly coloured overcheck designs, 3½lb. in weight. Brand NEW.
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In 40ft. lengths, 3-16in diameter.
This cord is comprised of 14 strands of best quality elastic and covered with cotton. Price, per 40ft length **6/6**

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Height and Airspeed Computors, aluminium calibrated disc types. Original cost £7/15/-.
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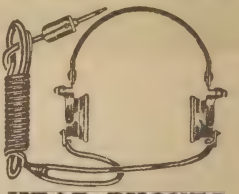

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COMPONENTS INCLUDE THESE VALUABLE LENSES.

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No. 1 diam. 3⅜ Foc. Len. 10in. No. 2 Diam. 3¾ Hollow Ground No. 3 Diam. 3¼ Foc. Len., 4½in. plus No. 4 Diam. 2⅜ Foc. Len., 6½in. plus No. 5 Diam. 1⅛ No. 6 Diam. 1-18 Amber Coloured ordinary.

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and received as purely electrical phenomena. But, no; we proceed to marshall them into the confines of language and scale, resorting to mechanical devices like vocal chords to produce an air disturbance.

Our opposite number has to go through the whole process in reverse to generate a stimulus something like the original.

CONTRADICTIONS

By long usage, we've come to accept this as a very necessary—even a desirable—state of affairs. We sort the sounds into the good, bad and indifferent, and even originate mechanically a variety of stimuli which we find pleasing. I do it, too; but it doesn't alter the fact that the process is a rather primitive one.

How, then, can we blame the engineer if he can't reconcile the contradictions inherent in acousti-electrical transfer — contradictions which even Nature doesn't solve.

For that's the way it is. The design of these devices is a mass of contradictions.

A speaker cone must be small to radiate the high frequencies properly, yet large to move enough air at the base end. It must be extremely light and fragile to produce transients, yet good and strong to handle the lows. It must be lightly damped to move fast, yet heavily damped to prevent free oscillation.

With pickups, it's much the same story. Deep grooves, solid stylii, and plenty of weight are desirable for ruggedness, but they're directly opposed to the qualities that make for good reproduction.

Mind you, the whole idea of gramophone records is unsound, I feel, because it lays unnecessary stress on mechanics. I know that records are easy to make and duplicate, and that's been justification, thus far, for their use. But how primitive the whole idea is!

SQUARE CURVES

Because we want high fidelity, we pour all we've got into a poor, inoffensive lathe-tool—and then wonder why the stylus won't go around the nearly square curves which result. We load the said stylus with a weight counted in tons per square inch and wonder why it wears.

I'm all in favor of wire or tape recording as a method of approach. It's still mechanical in the sense that it rearranges finite particles under a finite gap, but the process is a lot less primitive in its conception. There's none of this dragging business, and nothing gets knocked about if the level is accidentally turned up too far.

Of course, that's not everything, and, even if the problems of cost and "prints" were solved forthwith, I'm not so sure that the public would go for the new medium on the mere ground that it was worth listening to.

As spokesmen for the quality fans, we'll probably keep on saying rude things about record distortion, but with a little fellow-feeling for the recording engineer.

This might look like a reversal of form, "pushing the barrow" for the designer of devices connected "fore and aft" our pet amplifiers. In actual fact, most of the said designers are themselves quality fans, but public demand diverts a large proportion of their efforts to producing the mediocre more cheaply.

Thus, while there are enough enthusiasts to make better products worth while, the bulk of the listening public just doesn't care and it's problematical whether it ever will!

It's easy to condemn such a statement as defeatist but a recent item in the well-supported American mag., Audio Engineering, is worthy of mention.

It tells how a nameless US manufacturer was inspired to produce a better-than-average radiogram. He collected some of the better national brands, set them up in a test room with calibrated microphone, fed in pure sine-wave modulated signals and proceeded to measure the intermodulation distortion.

> I DON'T want to argue with Neville in print when I can bash his ear in person at lunchtime. But I think maybe he is a bit hard on the disc record, what it can do, and its many practical advantages. Perhaps my pre-occupation with home recording has given me new respect for the achievements of the record-making boys, but even if discs have serious limitations compared with the ideal, they must be taken seriously if they give satisfactory results within the limits required of them. After all, isn't that a fair statement of normal engineering approach? Secretly I think he agrees with me, but as you have discovered, he's a tiger for an argument. I wonder if other readers think the way I do.—Editor.

At half their rated maximum output most of the sets turned out about 25 per cent intermodulation distortion—a figure which included none of the complications of imperfections of typical programmes, records and pickups. (What price our earlier assessment?)

The engineers then went to work and revamped one of their existing models, cutting the distortion to a mere fraction of the former figure.

The model did NOT sweep the market, it did NOT sell better than its competitors and, in fact, there was a suggestion that the sales were below average. Main criticism of the set was that it did not sound as loud as others, from which it was assumed that the ear interpreted intermodulation components as "loudness"—more watts for your money, quality notwithstanding!

From the same source comes a report on "all-purpose" needles, intended to play both microgroove and standard recordings. Though engineers know perfectly well that there never can be a real solution to the problem, they are forced to produce something which is tolerable, provided the channel is limited to about 4 kc. The US public, which probably isn't very different from the Australian version, would rather put up with this than be bothered fiddling with interchangable stylii and the like.

So there it is. While a few of us enthuse over better quality and spend our money on the same, the despised "common herd" demands devices which, by their very nature, cancel all the best intentions.

LISTENERS' PREFERENCE

But before proceeding to the wholesale slaughter of those who fail to see eye to eye in this high fidelity business, it is necessary to decide, after all, what we do want to hear. Do we really want to reproduce the original or do most people genuinely prefer a watered-down "radio" version.

This gets down to what I called the aesthetics of reproduction in an earlier article. Comment on the subject was noticeable by its absence and I was left in doubt as to whether readers knew what I was talking about or whether it was dismissed as unimportant. Let me assure you that it's most important, for it will determine the whole future course of reproduction and perhaps of music itself.

In the October issue, a very widely-known contributor, Professor A. M. Low, suggested, and I quote:

Twenty years from now . . . "millions of people will have had 30 years of listening to music on the wireless and will hardly be capable of hearing the full range of 'real' music. Wireless completely cuts out the reproduction of sound frequencies above 5000 cycles and custom will have made the limited reproduced sound seem more 'Natural' than the real sound."

What brought this to mind most forcibly was a recent occasion when I found myself right in front of a brass band, with the instruments going full bore only a few feet away. Their output on some notes was loud, strident and distorted. I don't mean the refined type of distortion either, which modifies the wave shape and makes one instrument sound different from another. It was a loud, raucous blare which, if emanating from a loudspeaker, would have prompted a check of bias, or something.

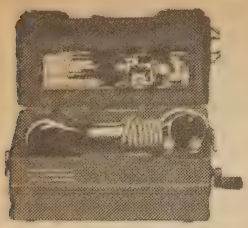
Fifty yards away the effect was much more melodic because some of the high order harmonics and the transients had been lost in transit.

EFFECT OF DISTANCE

Put a mic. near the same band, turn up the wicks in a high-fi system and you'll get the same native blare. Whip in some treble loss, slow up the transients and you'll find yourself electronically back up the street, where the effect is more melodic and much less demanding.

I know I've chosen a rather severe example, but the same holds true in differing degrees with any instrument possessing acoustic personality and

(Continued on Page 95)



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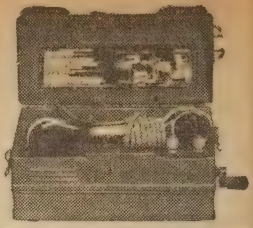

ENGLISH THROAT MICROPHONES

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Liquid damped card type, 6½ in. dia. by 3½ in. deep, fitted with large viewing prism. Ideal for small craft, &c. For normal navigation and also taking bearing. EACH **£6/10/-**

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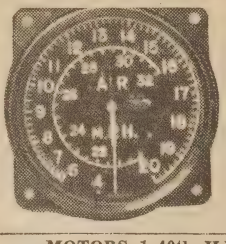

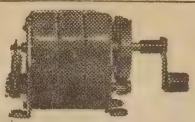

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ELECTRIC MOTORS

24 volt DC-AC. 1/10th H.P. with Laminated Field **£2/10/-**

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MOTORS 1-40th H.P. 3 PHASE, 50 VOLT

CAN BE REWOUND TO 230 VOLT. PRICE **35/-**

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18" x 18" COMPLETE WITH PANTOGRAPH **17/6**

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Two four foot sections, ideal for car aerials, or fishing rods. EACH **15/-**

MINE DETECTORS

The war-time mine detector is now doing a very useful peace-time job and has proved invaluable to PLUMBERS, GAS-FITTERS, and MUNICIPAL COUNCILS. It originally worked on the principle of finding the metal casings of mines. When it found them it whistled.
Metal pipes and cables can be traced quite easily in the ground. This saves the laborious, costly and time-wasting digging of "search holes" when the underground path of the pipes is uncertain, as it frequently is. And throughout all, the metal detector "whistles while it works."
The unit consists of two interchangeable sweep coils, one large and one small, and is complete with carrying pack, valves and headphones, packed in strong wooden transit cases, 10in. x 12in. x 4ft. 6in. (total weight 80 lbs.). PRICE £8/10/- EACH, F.O.R.

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These contain a 24-volt motor approx. 1-10th H.P. that can be revolved in either direction, A.C. or D.C. . A magnetic brake and a 5000 to 1 reduction gearbox. F.O.R. PRICE **£2/17/6**

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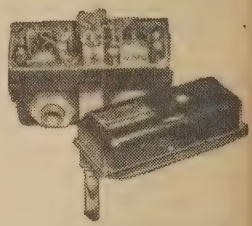

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Made by Bendix Aviation Corporation. Suitable for use with home lighting plants. Can be adjusted for use on 32 volts system. .. **£3/10/-**

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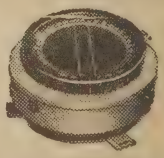


COMPASS TYPE P.8

5¾in. dia. x 2¾in. deep accurate Aircraft type navigation compass. Reconditioned as New **37/6**

Postage and Packing: Vic., 2/-; N.S.W., S.A., Tas., 3/6; Q'ld., W.A., N.T., 5/-.

A-C VOLTAGE SCALES MADE LINEAR

By G. F. CRAVEN

The non-linearity of a-c scales on low voltage ranges is usually accepted as a necessary evil. This contributor from the old country suggests a simple method of compensation which experimenters may care to try.

THE usual method of measuring AC by means of a moving-coil instrument is to include a full-wave bridge rectifier in the circuit. If the instrument is to be used for AC -DC measurements, certain inherent defects arise which are due to the non-linear characteristics of the rectifier over a percentage of the meter scale.

With a full-scale reading of, say, 15 volts, the non-linear percentage of the reading is negligible, but for full-scale values below this value the non-linear percentage may be in excess of 50 per cent. One method of overcoming the non-linearity of the scale at low voltages is to include a potential transformer which raises the input voltage to a value which is outside the non-linear range.

This method is successful where comparatively heavy currents are flowing, but for light current work the voltage drop due to the current drawn by the transformer introduces serious errors.

AC MEASUREMENT

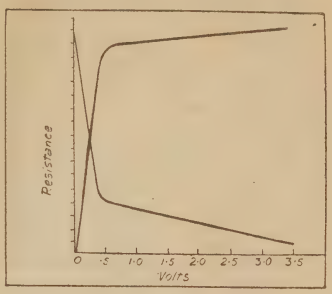
Similarly, on AC current measurements it is impossible to use a rectifier-moving-coil combination across a shunt, as the meter is then operating as a low-reading volt-meter and has a very bad scale shape. Here again a transformer is used, the design of which is extremely difficult where small bulk is required with accurate results.

To overcome these difficulties and to provide a scale which is absolutely linear on any AC voltage or current measurements, a circuit has been evolved which is entirely suitable for inclusion in a universal meter. It has the great advantage of using the same scale for AC-DC measurements without transformers, and introduces no more error in the readings than any high-resistance meter with bad scale shapes.

CURVES

Consider the characteristic curves of a copper-oxide rectifier. It will be heen that as the voltage rises, the resistance of the rectifier element falls in one direction and rises in the other according to the polarity of the voltage.

It is these changes in resistance which provide the rectifying action, the impedance being very high for curents flowing in one direction and very low when flowing in the reverse direction. As will be obvious from the curves in Fig. 1, the changes in resistance are non-linear in the extreme.



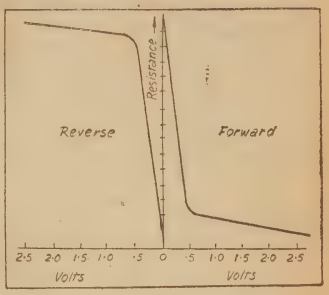


Figure 1 (above) illustrates the resistance characteristics of a tyyical rectifier. Figure 2 (right) suggests how they can be combined.

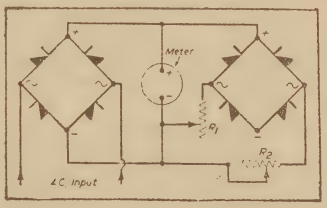


Figure 3. A compensated rectifier circuit.

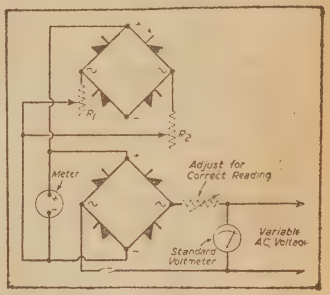


Figure 4. Calibration as an a-c voltmeter.

Consider now Fig. 2. If one curve in which the resistance is decreasing is superimposed upon a curve where the resistance is increasing, the resultant curve will appear as a straight line and will, therefore, give a linear scale. This method of compensation is the one used in the circuit about to be described.

The instrument and its conventional rectifier are coupled in the usual manner. A second instrument rectifier, identical in characteristics to the first ie, current rating, manufacture, &c, is coupled in parallel to the meter. The positive side of the compensating rectifier is taken directly to the positive terminal on the meter, whilst the negative side is not connected. From each of the AC terminals on the compensating rectifier a connection is made to the negative side of the meter via a variable resistance (Fig. 3).

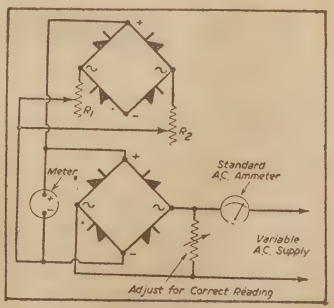


Figure 5. Calibration as an a-c ammeter.

BALANCE RESISTORS

The function of these resistances is to balance any slight discrepancies in the rectifier elements and may be adjusted to give perfect linearity. Once set, they need never be altered again. The values of these variable resistances should be variable from zero to approximately 10 times the meter resistance.

To calibrate the instrument as a voltmeter, the series resistance to give full-scale deflection is very nearly 90 per cent of that required to give full-scale deflection on DC. For accurate results, a variable re-

(Continued on Page 104)

FROM THE SERVICEMAN WHO TELLS

In the first two articles of this special series, the author has explained the principles of double-entry bookkeeping as applied to purely cash transactions. This third article covers the application of the system to credit transactions, both buying and selling.

BY now you will have grasped the importance and usefulness of "Double Entry" book-keeping. In addition if you have followed the procedure outlined, you will have the satisfaction of knowing that your books are in order and that they will bear the scrutiny of any Income Tax inspector. Furthermore they tell you all you want to know about your business.

Just a glance at your Trial Balance shows you what stock you have purchased, what sales you have made, what your expenses were and what money you have in the Bank

We saw last month that it would be a very desirable state of affairs —from an accounting viewpoint anyway—if all your transactions were cash transactions. You would not have to worry about how much you owed for stock you had purchased. Neither would you have any anxiety occasioned by "bad" debts —people for whom you had done work or sold goods but who had never paid you.

"Credit" transactions, however, are such an integral part of modern business that it is inevitable that, sooner or later, you will become caught up in them.

Actually dealing on "credit" is a very convenient form of doing business. It is so convenient that there is always the danger of "over" buying or "over" selling. One is as dangerous as the other.

BUYING ON CREDIT

When you buy goods on credit, the firm supplying the goods simply trusts you for that amount of money for a certain time (usually 30 days) On no account buy more than you can pay for when the due date arrives.

Likewise do not give credit unnecessarily. Remember that you have to get your money in to enable you to pay your creditors and to pay yourself a salary. If you have large sums of money owing to you for long periods, your business cannot be the success you want it to be.

Taking things in order, we can first discuss Credit Accounts. The distinctive feature about these credit accounts is that two transactions are involved—

1. The actual purchase or sale.
2. Payment for same.

It naturally follows that two sets of Double Entries are required to record them.

You are already familiar with the operation of the cash stock and we will therefore deal with the "Purchase Book" which is used to record purchases on credit and the "Sales Book" in which is entered sales on credit.

These are the two subsidiary books which are used in conjunction with the Ledger. Postings are made from them in a similar manner to the postings which we made from the Cash Book.

Figure 1 shows you the layout of a typical Purchase Book. We will assume that, in addition to the cash purchases you have made, and which were shown in your original Cash Book that you have made purchases from a number of firms on credit. The greater part of these were stock for resale but there were also items of expense such as advertising, stationery, &c.

The Purchase Book shows a record of all the firms from which you have bought goods in any one particular month.

Invoices are issued with all goods supplied. You should therefore receive an invoice every time you receive goods. The invoice will state the goods received and the amount charged.

PURCHASE BOOK

It is quite probable that you may purchase several lots of goods from a particular firm in any one month. For this reason it is always better to wait until the month is finished and your receive a statement of your account from that firm before writing up your Purchase Book

The Purchase Book is a book similar to the Cash Book but usually having more columns. When you purchase one make sure there are plenty of columns to meet your needs. The cost is about 6/-. We do not regard this book as having

By

C. H. PEARCE

and debit or credit side. The book is primarily designed to give you a split-up of your purchases into the various expenses they represented so that you can have totals for each item of expense for the month.

Referring to our Purchase Book you will see that you purchased goods from the L.M. Radio Co., value £20 Now you will see the operation of the various columns. You will remember that the purchases account consists of goods bought for re-sale only. Of this amount of £20 only £18 represents stock for re-sale the other £2 is a charge for freight. As freight is not bought for re-sale, the £2 is entered in the freight column. This, together with £18 for stock, makes up the full amount of £20 which is entered in the total column.

All dissections must cross-add and agree with the total column.

The next transaction with the O.Z Battery Co. was for more stock for re-sale and in this case the whole amount goes into the purchases column.

CROSS ADDITION

The two following transactions with the T.V. Speaker Co. and The Valve Manufacturer Co. are of a similar nature and both amounts are therefore again recorded in the purchase column.

We come to the Quick Printing Co. Ltd. who prepared some advertising leaflets. The amount of £7 is thus an advertising charge and is entered in the appropriate column. The same procedure applies to the next item. The firm's name—Stationery Sellers Ltd.—is entered and the amount (£6) recorded in the stationery column.

The last transaction for the month was with the Y. Radio Co. when you purchased additional test equipment. The total charge included £1 for freight therefore only £10 will be entered in the special column provided for purchases of plant. The freight charge will go in its own column and the total £11 in the total column.

When you have entered all your purchases, total each column up. The subsidiary columns should all agree with the total column. If you check them up you will see that they do.

We are now in a position to do our posting from the Purchase Book. First of all it will be necessary to open up new accounts for the firms from whom you have bought goods. Reference to Figure 2 will show you last month's Ledger and the postings you have already made. In order that you may follow them easier, this month's postings are in heavier type.

Let us now open accounts for the firms from whom you have received goods. The first is the L.M. Radio Co. Since the L.M. Company did not receive the goods but gave them to you, their account has to be credited with the £20. This means that you owe them £20. The same applies to the Battery Company and the other firms from whom you bought goods, &c.

(Continued on Page 99)

Page 1

CAPITAL ACCOUNT

	£ s. d.
Oct. 1. By Cash	200 0 0

Page 2

SALES ACCOUNT

	£ s. d.
Oct. 30. By Cash	82 0 0
Oct. 30. By Goods	151 0 0

Page 3

SERVICE ACCOUNT

	£ s. d.
Oct. 30 By Cash	18 0 0
Oct. 30. By Goods	14 0 0

Page 4

PURCHASES ACCOUNT

	£ s. d.
Oct. 30. To Cash	100 0 0
Oct. 30. To Purchases	79 0 0

Page 5

SALARIES ACCOUNT

	£ s. d.
Oct. 30. To Cash	20 0 0

Page 6

FURNITURE AND FITTINGS ACCOUNT

	£ s. d.
Oct. 2. To Cash	30 0 0

Page 7

PLANT ACCOUNT

	£ s. d.
Oct. 2. To Cash	30 0 0
Oct. 30. To Purchases	10 0 0

Page 8

RENT ACCOUNT

	£ s. d.
Oct. 2. To Cash	5 0 0

Page 9

ADVERTISING ACCOUNT

	£ s. d.
Oct. 10. To Cash	3 0 0
Oct. 30. To Purchases	7 0 0

Page 10

TELEPHONE ACCOUNT

	£ s. d.
Oct. 14. To Cash	5 0 0

Page 11

POWER AND LIGHT ACCOUNT

	£ s. d.
Oct. 25. To Cash	2 0 0

Page 12

L. M. RADIO CO.

	£ s. d.
Oct. 30. By Purchases	20 0 0

Page 13

O. Z. BATTERY CO

	£ s. d.
Oct. 30. By Purchases	16 0 0

Page 14

T. V. SPEAKER CO.

	£ s. d.
Oct. 30. By Purchases	5 0 0

Page 15

VALVE MANUFACTURERS

	£ s. d.
Oct. 30. By Purchases	40 0 0

Page 16

QUICK PRINTING LTD.

	£ s. d.
Oct. 30. By Purchases	7 0 0

Page 17

STATIONERY SELLERS LTD.

	£ s. d.
Oct. 30. By Purchases	6 0 0

Page 18

Y. RADIO CO.

	£ s. d.
Oct. 30. By Purchases	11 0 0

Page 19

STATIONERY

	£ s. d.
Oct. 30. To Purchases	6 0 0

Page 20

FREIGHT ACCOUNT

	£ s. d.
Oct. 30. To Purchases	3 0 0

Page 21

J. JONES ACCOUNT

	£ s. d.
Oct. 2. To Goods	35 0 0
Oct. 27. To Goods	4 0 0

Page 22

S. SMITH ACCOUNT

	£ s. d.
Oct. 10. To Goods	4 0 0
Oct. 27. To Goods	24 0 0

Page 23

T. HARRIS ACCOUNT

	£ s. d.
Oct. 11. To Goods	8 0 0
Oct. 27. To Goods	29 0 0

Page 24

J. KENT ACCOUNT

	£ s. d.
Oct. 19. To Goods	28 0 0

Page 25

K. BARRY ACCOUNT

	£ s. d.
Oct. 22. To Goods	33 0 0

Fig. 2.

AMATEURS—DISPOSALS—EXPERIMENTERS

MIDGET GENEMOTORS

Input: 28 volts at 1.1 amps. Output: 250 volts at .06 amps. Size: 4½ x 2¾. Weighs only 3 1-8 lbs. Perfect for use with 32 volt domestic receivers.

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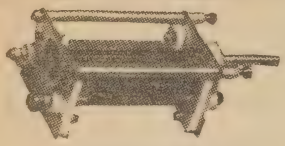
Postage & Packing, 3/-.



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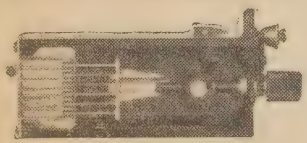

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£5/10/- F.O.R.

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70/-

Postage & Packing, 4/-.

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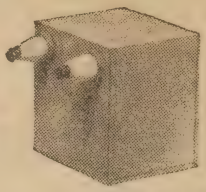

H. V. TRANSFORMERS

80 to 3200 volts, 500 cycle type. Excellent as a spark coil for electric fences.

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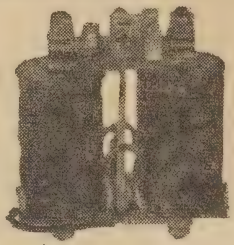

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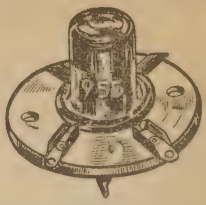

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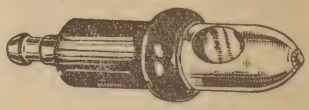

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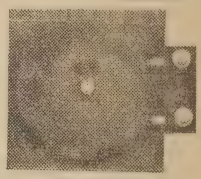

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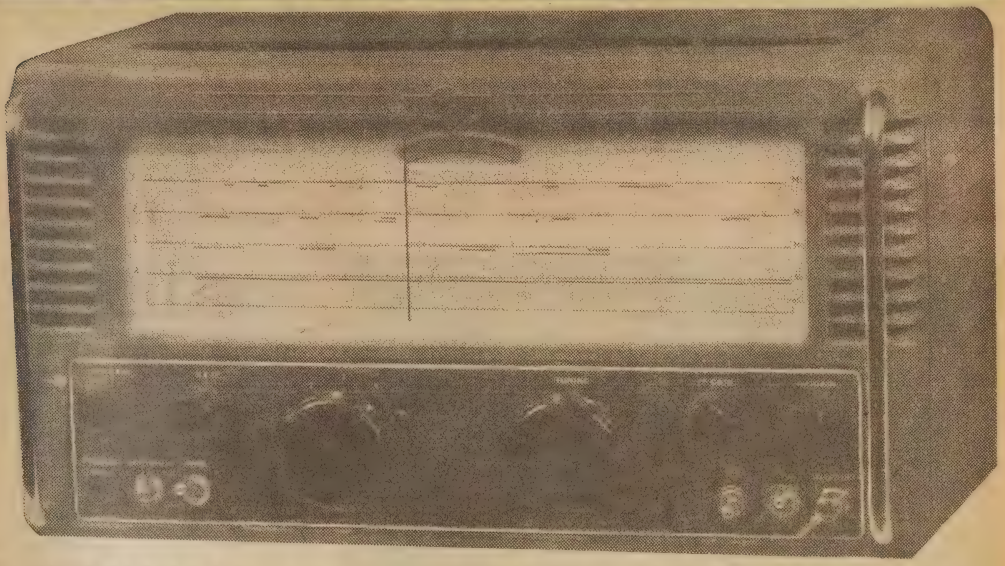


EDDYSTONE '750' RECEIVER PERFORMS WELL

A communications receiver which appears to include just about every feature one looks for in such a set is the Eddystone 750, a sample of which has been in use for some days in our laboratory. Its performance during that time has been particularly good, and its handsome appearance the subject of comment.

THE receiver is a continuous coverage job from 480kc to 32mc with an exception of the band from 1465 — 1700kc. This is necessary because the second intermediate frequency is 1620kc and requires a guard band above and below. Total coverage is taken in four switched bands, and read off on a calibrated dial.

Eleven valves are used in all in a mixture of English and American types.

The circuit includes an RF stage (6BA6) followed by a mixer (ECH42) and separate oscillator (6AM6). The second converter, fed at 1620kc, is an ECH42, followed by a single IF stage at 85kc. (6BA6). Further valves operate as detector — audio amplifier — AVC, noise limiter and "S" meter, output pentode, BFO stage, rectifier, and voltage regulator.

CONTROLS

The controls include, apart from a tuning knob, a band selector, RF gain control, IF gain control, audio control, BFO switch and pitch adjustment, noise limiter, standby, mains on-off, and variable selectivity adjustment.

Sensitivity is given as better than 5mv at all frequencies.

The tuning dial we found particularly pleasant to read. It is indirectly lit, and in addition to normal calibrations, with broadcast and amateur band picked out in color, it has an accurate vernier scale read through a "window" in conjunction with an extra scale on the main dial. This vernier dial gives about 32 feet of bandspread for full scale reading.

PERFORMANCE

The general performance of the receiver we found to be good, and quite up to communication standard. Freedom from images was, of, course most apparent, and the efficiency of the variable selectivity most helpful when picking out difficult stations from a crowded band. Sensitivity was reduced with full selectivity, but not unduly so. In fact, this control appealed as being a neat piece of work.

Signal-noise ratio was also good, and not likely to be improved upon except possibly by special, single band receivers.

Constructionally the set is typically English. The entire tuning unit appears mounted on a cast aluminium subchassis, which, no doubt, contributes to the good stability in operation.

FERGUSON CHARGER TRANSFORMER

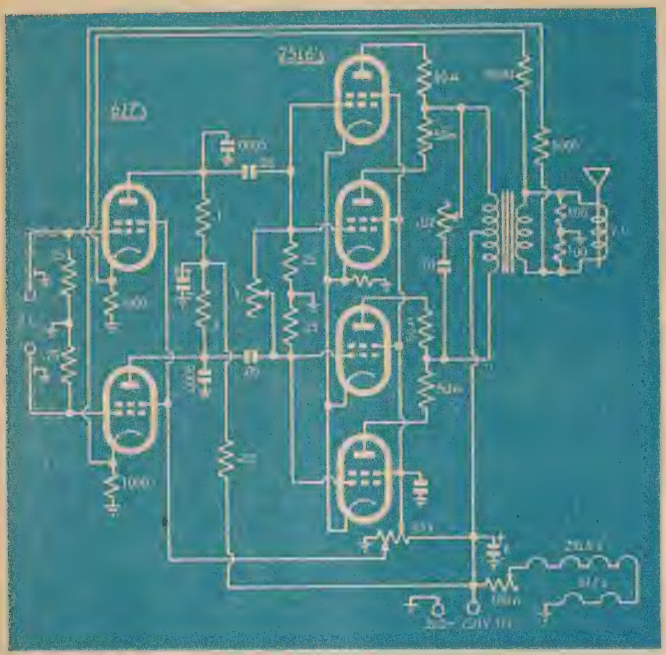
LATEST addition to the Ferguson range is this transformer for use in home battery chargers. It has been designed to meet specifications suggested last month for our "Kit No. 5."

Designated as type PF265, it has a 17-volt, 4.2 amp. secondary, tapped at 11.5, 10 and 8.5 volts. Used in conjunction with an Lt53 rectifier and a 1-ohm ballast resistor, it will charge accumulators ranging from 2 to 12 volts.

A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

AN AMPLIFIER FOR D-C POWER MAINS



Readers living in d-c areas will be interested in this circuit for a high-powered amplifier submitted by a reader from Western Australia. Using four output valves in parallel push-pull, it will deliver best part of 20 watts to the speaker system.

THE designer of the circuit, Mr. Howard Iffla, of 81 Wilson Street, Kalgoorlie, says that, for all its simplicity, it has proved an excellent proposition for dancing and general listening in a hall.

Readers who may be interested to construct such an amplifier are warned to be most careful in the construction and installation to avoid contact with the active lead by way of the chassis and any leads connected to it.

The very nature of d-c or ac-dc equipment demands that a direct connection be made between one side of the mains and the "earth" points shown in the circuit. If these "earth" points are connected in turn to the chassis, it means that the chassis, together with possible microphone, pickup and speaker leads are also connected to one side of the mains. If the chassis, by necessity or accident, is common with the active power lead, then a lethal shock awaits anyone who completes a circuit between any part of the installation and earth.

BUSBAR

Some of the difficulty can be avoided by returning all "earth" points in the circuit, together with the mains return lead, to a carefully insulated busbar inside the chassis. The busbar is then connected to chassis only through a large high-voltage blocking condenser. If the chassis, together with all outgoing leads is then carefully earthed, the shock danger is eliminated.

Great care is obviously necessary during any preliminary testing. Readers who do not fully appreciate these difficulties are warned not to attempt the construction of any d-c or ac-dc equipment.

The circuit suggested by Mr. Iffla employs push-pull throughout, two 6J7 type valves driving four 25L6's. To avoid the need for a phase-splitter, the output from the pickup was fed directly to the two grids, with a resistor from each grid to earth.

To be suitable for this application, the pickup should have two active leads brought out, rather than a single lead plus shielding. If, furthermore, the pickup arm is of bakelite, and any needle screw is covered, there will be no danger to anyone handling the pickup.

DOUBLE POT.

The immediate difficulty about the push-pull arrangement is that any form of volume control ahead of the first two grids would necessitate a double-ganged potentiometer, which is well outside the realm of standard components.

The arrangement used by Mr. Iffla sidesteps this difficulty, and, though unusual, works out well enough in practice. Negative feedback from the voice coil back to the two cathode circuits improves the tonal balance and also provides a means for adjusting the overall gain to suit the pickup chosen.

In setting up the amplifier, the heater resistor, which needs to carry the full 300 ma. continuously, would be set to apply a total of 112 volts across the heaters.

The screen supply for the 26L6 valves must be set at approximately 118 volts, while the screens of the 6J7 valves require about 50 volts for optimum results with the other operating conditions as stated.

Allowing about 50 milliamps each for the 25L6 valves, a cathode bias resistor of about 50 ohms would be required. Actually this figure could be increased somewhat, if necessary, to reduce the current through the output transformer primary. A power output of approximately 18 watts could be expected.

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M 5040 Jealousy (Tango), Gade, Poesy (Tango), Rixner, w/o VR Symph. Dance Orch., Kreuder.

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M 5043 Last Rose Of The Meadow (Stolz)—Dark, Red Roses (Milloeker), Karl Schmitt-Walter, Baritone w/orchestra.

M 5044 Roses from the South (Strauss). Vienna Blood (Strauss) Barnabas v. Geczy Orchestra.

M 5045 O Sole Mio (Di Capua)—La Paloma (De Yradier). Barnabas von Geczy with his Orchestra.

M 5052 O Romeo (Neroth) Samba-Muchachita (Panzutti), Samba Marion Soremba Dance Orch.

M 5063 Ballsirenes Waltz (Lehar), Walzertraum Waltz (Strauss), Lajos Kiss Gipsy Orch.

M 5065 Marienklaenge (Waltz), Strauss, Vienna Burghers (Waltz) Ziehrer, Lajos Kiss Gipsy Orchestra.

M 5066 Up And Down (Vossen) Foxt., Think Of Me (Vossen) Foxt., Jazz Harmonique Orch. w/o VR.

M 5067 So Blue (Gentner) slow waltz, Isle of Dreams (Kreuder) Foxt. A. Lutter Orch. and Terzett VR.

M 5071 Piano Medley (Orig. Teddies).

M 5075 Tango of Longing (Paasch)—Guitar Serenade (Fucik) Tango. Eric Helgar w/A. Lutter Orchestra and Schuricke Terzett.

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M 5079 So Nice (Mackeben)—Good Humor (Mackeben) Foxt. K. Hohenberger and his soloists.

M 5099 Ciribiribin (Pestalozzi) — Vieni Vieni (Scott). Erna Sack, Soprano w/orchestra.

M 5100 I Give My Heart-That's Mdme. Dubarry (Milloecker), Erna Sack, Sopr., w/ Orch.

M 5102 Ole Guapa (Malando) Tango—Porque Me Enganas (Malando) Tango. Adalbert Lutter w/Symph. Dance Orch. and Schuricke Terzett.

M 5112 Sirocco (Maschke) Fox. B 47 (Krautgartner) Foxt., E. Lehn "Yankee" Orch. w/o VR.

M 5114 Cubanacan (Morejon) Rumba—Minha Palhoca (Cascata) Samba. Ciro Rimac Orquesta Tipica w/Spanish V.R.

M 5115 Idolotria (Bianco) Tango, Dolor (Bianco) Tango, Orquesta Tipica Argentina.

M 5116 Return To Me (Olivieri) Foxt. That's Us (Vossen) Foxt. Alb. Vossen Orch. w/Schuricke Trzt.

M 5117 I Love Music (Drabec) Foxt. Fair Kate (di Lazzaro) Foxt. Ad. Lutter w/Symph. D/Orch., VR.

P 7005 Poeme (Fibich) Melody On Wings, Wurlitz Org. Solo, Schimmelpfeng.

P 7009 Linzer Buam (Drescher) March, Alpenlieder (March) (-) Zaruba's Swiss Peasant Band

P 7030 Rounddance (Heidegger) Vienna Puddin' (Hornischer) Zither Quintet.

P 7031 Village Musicians (Proell) Alpen-March (Gruber) Zither-Quintet w/Village Band acc.

P 7053 Alpenlaendermarch (Troniarsky), Parade-March (Neusser), Austrian Gren. Comm. Brass Band.

P 7054 Old Comrades March (Teike) Bosniaks March (Wagner), Austrian Gren. Com. Milit. Band.

F 101 Thy Prison's Darkness (Verdi), Return Victorious (Aida) (Verdi), Danizza Ilitsch (Sop.) Metrop. Opera.

F 102 Tosca's Prayer (Puccini), One Fine Day (Mdme Butterfly) Danizza Ilitsch w/ the State Opera Orch., Vienna.

E 1001 Land Of Smiles (Lehar). Excerpts—Elizabeth Schwarzkopf and Rupert Glawitsch w/Choir and Orch.

E 1002 "Aida" Ballet Music (Verdi), "Aida" Triumphal March, Berlin Philh. Orch. Schmidt-Isser.

E 1005 Rosamunde, Ballet music and Entre-Acts Music (Schubert) Berlin Philharmonic Orch., Cond. Schmidt-Isserstedt.

E 1008 "Meistersinger von Nuernberg" Quint. w/Konetzni, Hoengen, Schoeffler, Petrak, Moerwald, "Rosenkavalier" (R. Strauss), Finale, as above, w/Orch. Vienna State Opera.

E 1010 "Roses f. Tyrol" (Zeller) Duet "Nobody Loves You As I Do", Paganini (Lehar), Erna Sack-Marcel Wittrich.

E 1011 "Der Freischuetz" (Weber) Excerpts, 1st & 2nd pt. Peter Anders, I. Koegel, C. Spletter, H. H. Nissen, Berlin Philhar.

E 1012 Voices of Spring, waltz (Strauss), Lilacs Bloom In Sievering (Strauss - Stalla) Erna Sack, Sopr. w/ Orch. State Opera House, Berlin.

E 1013 "Flying Dutchman" (Wagner) Helmsman's Aria, Eric's Cav. Peter Anders, Tenor. w/ Orch. German Opera House.

E 1014 The Merry Widow (Lehar) Excerpts, Anita Gura, Sopr.-Peter Anders, Ten., Orch. State Opera.

E 1015 The Gipsy Baron (Strauss) "When We Were Wed," Duet "Rastelbinder" (Lehar), "When Two Are In Love", Duet, Peter Anders-Auliki Rautawaara.

E 1016 The Blue Danube (Strauss)—Roses from the South (Strauss) Erna Sack w/ Orch. of the State Opera House, Berlin.

E 1017 "Orpheus and Eurydike" (Gluck) Aria, "I Have Lost Her." dto Aria "Clear Heavens" Lorna Sydney Sop. w/ Orch. of the State Opera, Vienna.

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E 1042 Night In Venice (Strauss) Excerpts, F. E. Engels, Tenor, w/ Choir and Orch. of the German Opera House, Berlin.

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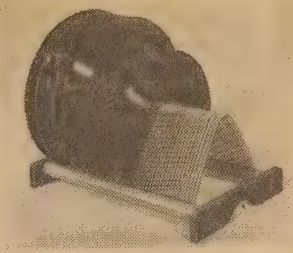

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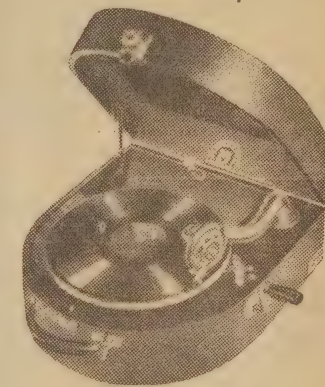

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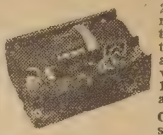

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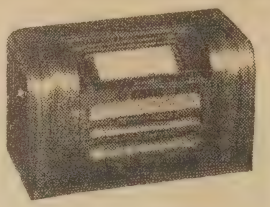

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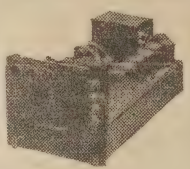

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Coaxial switching motors 24-volt D.C.
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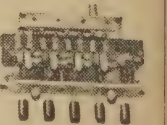

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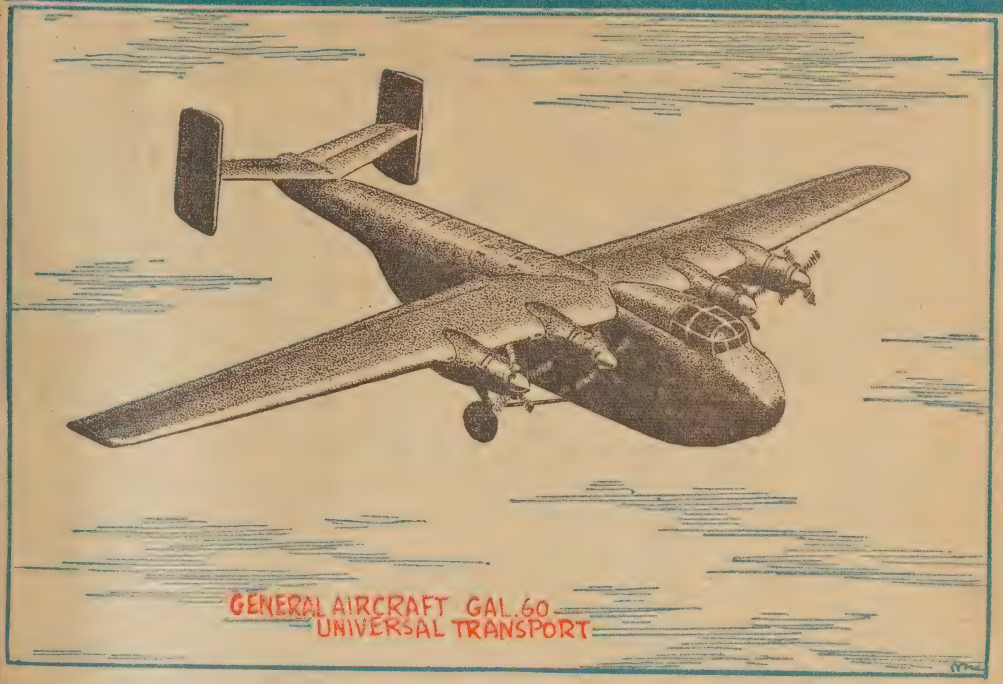
GIANT BRITISH FREIGHT AIRCRAFT



Second in size only to the Bristol Brabazon and Blackburn, General Aircraft's new "Universal Transport" is now flying in Britain. Designed to meet the demand for economical carriage of goods by air on a basis competitive with the lower rates charged for surface transport, the GAL-60, as this giant freighter is designated, is a four-engined, high-wing monoplane.

THE GAL-60 took shape on the drawing boards of General Aircraft Ltd., of Feltham, Middlesex. The company has been building aircraft since the 1930's, and has produced a wide range of passenger and cargo aircraft—notably the Monospar Croydon of 1936, the wartime Hotspur and Hamilcar military transport gliders, and the powered Hamilcar Mark X.

Experience gained in the designing of these types pointed the way to large-scale air transport at really low operating costs, and the company pursued the plan to produce a large freighter.

BIG TASK

After the design of the GAL-60 was completed, General Aircraft Ltd. joined forces with the Blackburn Aircraft Co. Much of the activity of the merged organisations has been devoted to the task of completing the new machine. The first of the two aircraft being built to the order of the United Kingdom Ministry of Supply was on show in September at the British Aircraft Constructors' Farnborough display.

Tricycle-type landing gear is fitted, the double nosewheel alone retracting.

The GAL-60 is visualised as being useful for either passenger or freight-carrying on medium-range services.

In the freighter version, total cargo space available is over 5700 cubic feet. Dimensions of the main compartment are: length 36ft, width 10ft, and depth 10ft. The 1830 cubic ft deck above can be used for various types of cargo or can be removed so as to give added headroom.

The non-skid floor of the cargo hold is reinforced to take heavy loads.

A built-in ramp, hydraulically operated, simplifies loading operations. This ramp is located at the aft end of the main section of the fuselage, the tail section being upswept to allow sufficient headroom underneath for loads up to 10ft high.

TAIL UNIT

The upswept rear fuselage gives the GAL-60 a characteristic line. The tail unit consists of a tail plane showing marked dihedral, at each extremity of which a rather square-cut fin and rudder are mounted.

In its passenger version the GAL-60 can provide comfortable accommodation at fares directly comparable with those of surface travel.

Equipped as a passenger transport, there is accommodation for 90 people, together with 3½ tons of baggage and freight. Seating is on a double-deck arrangement.

Passengers board the aircraft from the rear by way of a built-in retractable stairway. Both compartments are soundproofed and air-conditioned.

In both versions provision is made for ventilation and for heating sufficient to combat sub-Arctic conditions.

ENGINES

The four engines are Bristol Hercules. They are equipped with two-speed superchargers.

Cruising speed is about 180 miles an hour.

Fully equipped empty weight of the GAL-60 is 60,500lb. Still-air range is 870 miles.

On a 500-mile stage, payload is 28,000lb. For 1000-mile and 1750-mile stage operation, payload is reduced to 21,000lb and 13,000lb respectively.

A NEW HIGH-PERFORMANCE GLIDER

As a contrast to the articles for advanced modellers which have appeared in the last few issues, we go back this month to the simplest of all flying models. Although we have described many gliders in the past, they are so easy to make that the demand for new types remains firm.

by Jack Finneran

WELL chaps I'm back again with another article on model aircraft but before carrying on with that subject I should like to say something relative to Gil Miles' excellent articles on Radio Control for models which have appeared in these pages during the last few issues.

Here, I think is an excellent opportunity for model plane builders who don't understand radio to team up with Radio Hobbyists who don't understand model planes and so both get off to a very good start on what should be a very interesting project.

RADIO CONTROL

Mrs. Miles' articles will give you a very good basis on which to work. Are you interested? If so I will act as liaison officer between parties if you write me C/o Radio and Hobbies.

Now back to something far removed from Radio controlled models —that little wayward wayfarer of the air trails—the hand or catapult launched glider.

I suppose more of these things have been manufactured and more of them have been described over the years than any other type of model aircraft. Despite this they have retained their popularity, mainly, I should say because of their relative simplicity and soul satisfying performances.

There have been thousands of these small gliders sold over the shop counters in every shape and size and their general performance has been as bad as their construction.

However, the secret of success with these small fellows is careful construction and balancing. If these two details are carefully attended to, superlative results can be obtained.

Now to the task. As always, draw up your plan which is drawn full size for you. If you wish something bigger, double up the sizes and you will finish up with quite a nice ship.

THE MODEL

However, we propose to discuss the model as shown in the plan because we feel that you will get a lot of satisfaction from it.

If you, Dad, decide to build one for junior, better build two and be in the fun as well.

Your bill of materials is quite modest and will only cost you a few shillings. It is as follows:

Balsa wood. 1—1/16" x 3" x 7" soft wing. 1—1/32" x 2" x 4" soft stabiliser. 1—1/32" x 2" x 1¼" soft rudder. 1—3/32" x ¾ x 8¾" hard fuselage. 1—6" loop of 3/32" x 1/32" rubber. 1—tube of cement.

Since your plan is full size you will start construction by transferring the sizes from your plan direct to your balsa. Having done this you now cut out each part separately using a good sharp knife. When you have finished this operation you reach for that old standby the sandpaper.

Remember, it depends to a very large extent on how you handle the sandpaper as to how the model will look when finished.

Having cut out your wings, sand a slight airfoil section into them, remembering to round the leading edge and thin out the trailing edge to a knife taper. After roughing down near size with medium paper, use very fine paper to get that smooth finish which is so desirable for appearance and performance.

Now cement the two halves together and block up each tip 1" above the centre to give the dihedral angle. This dihedral angle as we call it ensures that the model will be stable in flight and acts in a manner very similar to the V-shaped keel on a boat.

STABILISER

The stabiliser and rudder are cut from very flimsy balsa. Only fine sandpaper should be used for finishing. Great care in sanding is necessary as otherwise you can easily buckle up the part being worked on. I would suggest that you sand in a direction away from the hand holding the part which is being worked on.

When working on the fuselage cut out in one piece for strength. We have drawn the fuselage in two sections only as a means of getting it on the plan more easily.

We are now ready to assemble the model. Firstly, we cement the stabiliser in place, making sure it is square with the fuselage when viewed from both the top and from the front. Now fit the rudder and note the slight offset given to secure a circling flight.

The rudder must be vertical to the stabiliser. The wing is now cemented firmly in place and lined up carefully square with the fuselage. Make sure that the wing and stabiliser have no incidence angle in respect to one another as this is most important.

The tow hook is now fitted and maybe made from a large household pin with the head removed. It must be cemented very carefully in place.

After all the cement joins have hardened, give them all another coat and allow over-night drying before attempting to fly.

Now for testing. The first thing to do is add some modelling clay to the nose to act as a balance weight. Add or remove weight so the ship balances at the point indicated on the plans.

TEST GLIDE

Now you are ready for a test glide. This can be done in the lounge room. Send it on its way with a slight spearing action and trim for a slow, flat glide. Add or remove clay from the nose to secure a smooth glide.

When you are securing smooth, hand launched glides, you are ready to try the rubber catapult launch which, due to its speed, will tend to show up any flaw in the adjustments.

Hold the rubber loop in your left hand and grasp the sub rudder in the right. Use only small stretch on your rubber at first and gradually work up to full power, making such adjustments as may be necessary from time to time.

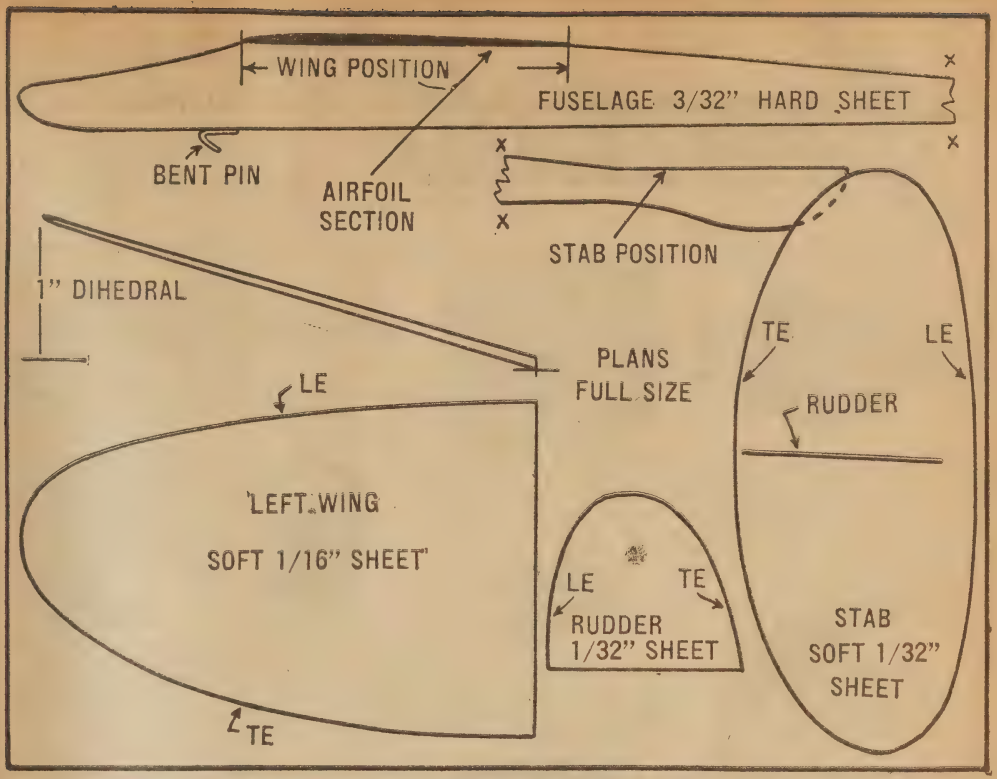
Well made and properly adjusted, this little ship will really step out and climb high for long soaring flights. Under very favorable conditions it is possible to lose these little gliders in a thermal, so you had better make two in any case.

RICE BLASTS REMOVE CARBON

CARBON in combustion chambers of automobile engines is quickly removed by a blast of rice without taking off the cylinder head. The spark plug opening is used to reach the insides with a new device developed in Lansing, Mich., by the Oldsmobile division of General Motors.

The device is called a head-on carbon blaster. It is a cylindrical affair with a double-hose connection to the engine. It sends high-pressure air and rice into the combustion chamber through a nozzle at the end of one hose. Used rice and carbon flakes are sucked out through the other.

The operator works the nozzle tip up and down inside the chamber, at the same time rotating it to blast all parts of the cylinder wall. The rice under pressure chips off the carbon and thoroughly cleans the surface.



THE LATEST—MULTIPLE PLANE FLYING

There are two distinct and separate phases contained within the heading which is virtually self explanatory. These two phases are team speed racing and combat or streamer cutting.

NOW let us say as a general picture, that multiple model flying has very good crowd appeal because with two or more planes in the air at once with both flying on the same length lines and within one anothers flight circle, there are some touch and go situations.

These affect the spectators with the thrill of close shaves, mid-air collisions and the "who'll be the winner" atmosphere. They also keep the contestant on their toes and lead to perhaps, greater satisfaction in having beaten so-and-so, instead of a stop-watch.

TEAM RACING

Team speed racing is designed around a set of rules which ensure that the model planes flown will have a definite scale-like resemblance to full size aircraft flown in the American Goodyear Trophy races. The motors must be fully cowled, there must be good visibility from the pilot's cockpit, and the plane must take off and land on its own undercarriage. There are also definite limitations on power used within the various classes and certain wing areas must be adhered to.

Races are flown with usually three or four contestants in the middle, and may be sprint dashes over one mile or else marathon events, which require frequent stops for refuelling.

The sprint dashes, of course, are mostly won by the racing type motors, which develop high power output, although occasionally, faster starting from slower motors may give them a lead which keeps them ahead of the field.

MARATHON

However, in the marathon events, the slower, more reliable, and less fuel-hungry sports motors are frequently more than a match for the high speed, fuel devouring fraternity. The more powerful motors have prodigious fuel appetites and the ground gained in the air from their high speed is often lost on the ground while refuelling and restarting.

These type events are really very exciting and entertaining, as they give that much-needed thrill of a race effect. The rules of flying in these events, is that the slowest plane must be flown at low altitude, so as not to obstruct faster machines which must pass over the top of any plane which they wish to pass. Consequently, you get movement right throughout the flight, with machines passing one another and coming in for landings, refuelling and take-offs.

In the distance races there is a pilot and two mechanics, and good work at the pits is a necessity, as time lost on the ground can mean many laps lost in the air. This is a phase of the hobby which is gradually gaining ground and, which will ultimately, become very popular.

Combat flying is a definite thrill, as in this, two machines with long streamers attached to their tails fight it out to the last inch of streamer (almost).

CUT THE STREAMER

The idea is to cut off the other man's streamer with your propeller. To do this you have to manoeuvre very close to the tail of his machine, while all the time, he is taking violent evasive action.

He, in turn, is endeavoring to turn the tables and may loop away from the attacking machine and get into an attacking position himself.

This goes on for lap after lap, with pieces of streamer floating away on the breeze as one or other machine scores a hit. All the time there is an intricate stunt pattern being flown by each machine, and near collisions bring roars from the spectators.

The best contest is had when two machines of similar speed and

manoeuvrability take part, as close action is usually maintained right throughout the flight and tough situations are constantly coming and going.

However, quite an amount of interest can be had from a fast, straight flyer and a slow, manoeuvrable one, as it is almost impossible for the slow job to score a hit and nearly as difficult for the fast job to get into a favorable position for the kill. The near misses are more spectacular as the planes close and part at much greater speed.

The contest finishes as the machines run out of fuel and the winner is the one who has the largest amount of streamer still remaining on his plane.

Mid air collisions are quite frequent and damage to one or another machine is usually the order of events in these cases. One or both may crash spectacularly to the great delight or chagrin of various sections of the crowd.

All in all, it is good fun to fly combat if you can take it, because the crowd most certainly can.

When is the moon really full? The moon is full when the earth is exactly between it and the sun. At that time the full moon rises just as the sun sets. The moon also looks full a day or so before and after the true full moon, but if it is already well up in the sky at sunset, it is not yet full; and if it rises well after dark, it is already past the full point.

STARVATION AFFECTS HEART

The heart grows smaller when food intake is reduced to that of a semi-starvation diet. At the end of six months the subjects showed the signs of famine victims.

WHEN a man is on a semi-starvation diet his heart grows smaller.

In the Minnesota Experiment, made at the University of Minnesota in Minneapolis with 32 conscientious objectors during World War II X-ray measurements of heart size showed that the heart volume decreased 17 per cent during six months of semi-starvation.

These findings, contrary to statements "in every major textbook of physiology since 1900," are reported by Drs. Henry Longstreet Taylor and Ancel Keys.

The brain, on the other hand, and the skeleton and the proteins of the blood serum remain almost intact during semi-starvation.

Fat, muscle, liver and skin, like the heart, undergo large losses.

But although the heart grows smaller the work done by it during starvation decreases by about half. This is a protective change that can be considered an adaptation of the body to the stress of starvation.

The way in which the body adapts to a starvation diet, however, is quite different from the way it adapts to such stresses as high-altitude living, heart disease or an increase in temperature of the environment.

The men in the Minnesota Experiment lived for six months on a diet of potatoes, cabbage, turnips and cereals with only a few grams of animal protein a week. The diet provided an average of 1570 calories daily, or slightly less than half the 3492 calories the men consumed each day of a three-months control period before the semi-starvation diet.

At the end of six months of this diet the men had lost 24 per cent of their body weight and showed the classical signs and symptoms of famine victims, such as dropsy, anaemia, disturbed heart and kidney function, weakness and depression. They lost strength and endurance to a marked degree, and said they felt "as if they were rapidly growing old. They felt weak and they tired easily. They moved cautiously, climbing stairs one step at a time and obviously reduced unnecessary movements to a minimum."

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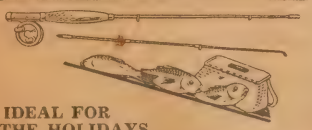

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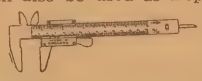

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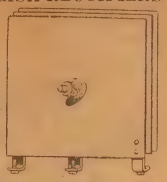

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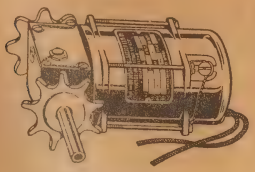

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A PUPPET SHOW FOR CHRISTMAS

Television in both England and the US has staged a comeback for the marionette. Make up a couple of figures between this and Christmas. You may have a future television star in your family.

A MARIONETTE is a puppet or jointed figure worked by strings. To make one is not nearly as difficult as many people suppose; a large degree of success depends not on the making, but on the manipulation and presentation, for which considerable practice and a definite flair is necessary. Nevertheless, this practice can afford a great deal of fun, so if you enjoy doing things with your hands why not try your skill as a puppeteer?

This article is written very much for the beginner, and the suggestions in it can be elaborated according to your skill. Far more important than the technicalities is the original conception of the puppet to be made. It must first be visualised in great detail; think about the personality, voice characteristics and movements, as well as the shape of the nose—which of your friends would be fun to satirise? Even a circus clown, a variety act or a puppet for a play should be based on observation of people you have met. But whatever you decide, the puppet should as far as possible go one better than his human counterpart, for this is where its success will lie. To take examples: Punch not only excels us in his grotesque appearance but in his extravagant doings; Muffin the Mule and his Hogarth Puppet friends are all caricatures.

THE FIGURE

When you have seen it clearly in your mind's eye, the next step is to draw the figure on a large sheet of paper, the actual size of the finished job. The height can be anything from 12 to 18 inches. Mark off where the waist will come, how long the head, arms and legs will be, and the whereabouts of the knee and elbow joints. This will be your working drawing. If you can draw in features, so much the better, but a few lines decipherable only by yourself are just as good, provided you have visualised them clearly in your mind.

The head of a marionette is generally made rather larger in proportion to the body than in the case of humans. It can be of wadding stuffed into an oval cover, with a nose, button eyes and woollen hair sewn on, or carved from wood (lime wood is probably the easiest for this) or made of plastic from a plaster of paris mould, or of papier mache. Here is a simple papier mache process.

The head is first modelled in plasticene. Roll it between the hands into an oval of the size required. The point of the oval will be the chin. Press out two hollows for the eyes with the thumbs. Roll two small eyeballs from some spare plasticene and place them in position. Make nose, lips, ears and hair in the same way and stick them on. A penknife is useful as a modelling tool for adding finishing details, parting the lips, &c. It is a good plan to look at the head in a mirror from time to time, to get a fresh idea of it. Do not go in for too much detail in the modelling. The broad effect is what is required: such things as eyelids and nostrils will not show over the footlights and are best left to the expert.

When you are satisfied with the head, get together some coarse newspaper, a bucket of water, a bowl of cold water paste and small brush, and a nice flat surface such as a sheet of glass or a tin tray. Tear the newspaper into sheets of equal size—about quarter of a full-size page. Dip one piece into the bucket of water, shake off the surplus water and lay it out on the tray. Give it a coat of cold water paste, dip another piece in the water and lay it on top of the first. Now cover this one with paste. Place a third piece of wet paper on top again and apply the paste once more, so that you now have a three-tier sandwich of paper and paste. Tear off little pieces of this sandwich

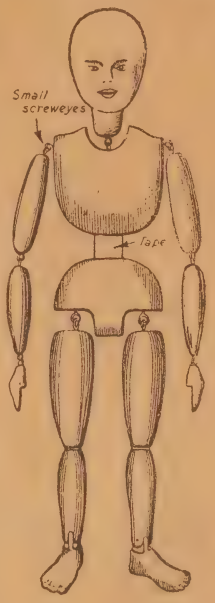
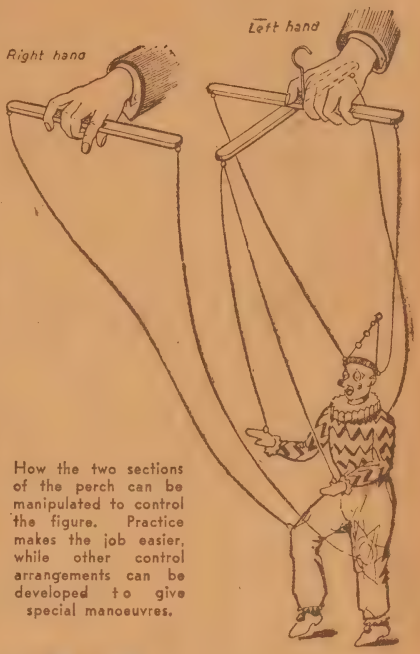
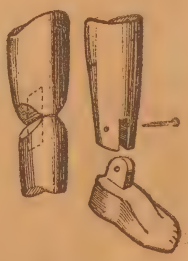
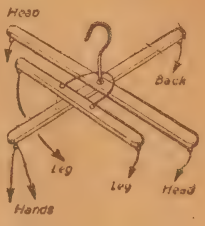


Figure 1. A completed puppet ready for clothing. The lighter the clothing is, the better.



How the two sections of the perch can be manipulated to control the figure. Practice makes the job easier, while other control arrangements can be developed to give special manoeuvres.





Figures 2 and 3. Showing the knee and ankle joints, also a typical arrangement of the operating perch.

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PF 165	200,30,40	385	60	6.3V @ 2A, 5V @ 2A	34/-
PF 170	200,30,40	285	80	6.3V @ 2A, 6.3V @ 2A, 5V @ 2A	39/10
PF 168	200,30,40	385	80	6.3V @ 2A, 6.3V @ 2A, 5V @ 2A	39/10
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OP54	5000, 2500 SE	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	10	45/8
OP39	5000, 2500 SE	15	10	39/10
OP33	5000, 2500 SE	5, 2.7	10	39/10
OP41	5500 SE	3.7	10	46/-
OP53	30000, 20000 14000, 10000, 7000 5000, 2500 PP	2.3	10	36/9
OP2	5000 PP	12.5, 8, 2.3	15	65/1
OP55	5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	15	73/10
OP3	6600 PP	12.5, 8, 2.3	15	65/1
OP56	6600 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	15	73/10
OP4	10000 PP	12.5, 8, 2.3	15	65/1
OP57	10000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	15	73/10
OP5	10000, 6600, 5000 PP	12.5, 8, 2.3	15	65/1
OP58	10000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3 2.7, 2.3, 2	15	76/2
OP59	10000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	25	93/8
OP60	10000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	32	116/8

OUTPUT TRANSFORMER TO LINE—P.A. Range

	Pri. Imped.	Sec. Imped.	Watts	Retail
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OP6	5000 PP	500, 250, 125	15	65/1
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OP50	8000 PP	600, 300, 120, 60, 30	15	128/-
OP8	10000 PP	500, 250, 125	15	65/1
OP8M	10000 PP	500, 250, 160, 125, 100, 83.5 71.5, 62.5, 55.5, 50	15	71/3
OP9	10000, 6600, 5000 PP	500, 250, 125	15	65/1
OP10	5000 PP	500, 250, 125	25	81/10
OP11	6600 PP	500, 250, 125	25	81/10
OP38	6600 PP	600, 300, 250, 200, 170, 150, 76, 50, 36, 27, 12.5, 7.5, 3.6, 2.7	25	140/-
OP12	10000 PP	500, 250, 125	25	81/10
OP13	10000, 6600, 5000 PP	500, 250, 125	25	81/10
OP35	10000, 6600 PP	500, 4000, 8.4, 2.2	25	120/-
OP14	5000 PP	500, 250, 125.	32	102/10
OP48	6600 PP	140, 70.	32	117/8
OP15	6600 PP	500, 250, 125	32	102/10
OP15M	6600 PP	500, 250, 166, 125, 100 83.5, 71.5, 62.5, 55.5, 50	32	104/1
OP16	10000 PP	500, 250, 125	32	102/10
OP17	10000, 6600, 5000 PP	500, 250, 125	32	102/10
OP36	3800 PP	17.6	60	108/7
OP18	3800 PP	500, 250, 125	60	108/7
OP61	3800 PP	100, 75, 25, 10, 5, 2	60	133/8
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OP49	8800, 6000 PP	500	105	210/-
OP20	11000, 8400 PP	500, 250, 125	150	276/-

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not much larger than a postage stamp and place them over the plasticene model.

Experience will show the best shapes to apply in different places. Where the modelling is elaborate the pieces of sandwich covering it should be smaller. Each piece should overlap the previous piece, so that in the end the model is completely covered. Eyes and lips can be given extra modelling in the paper itself as you go along. A matchstick makes a useful tool for this. The paper must be left to get quite dry and then the whole process is repeated, so that the head has now six layers of paper everywhere. This is enough for most purposes, but a third application will make the head very strong.

When the last application is perfectly dry, cut the head in halves from top to bottom behind the ears, scoop out the plasticene, and stick the two shells together wtih more paper sandwich. A wooden dowel should be glued in to form a solid neck and it is advisable to put a wooden bar inside between the ears which will later be useful to take screw-eyes for head strings.

THE BODY

The same technique can be used for all the other parts. However, for bodies wood is probably better, having more weight. The body is generally divided into two parts, loosely jointed at the waist by strong tape or linked screw-eyes. This gap is, of course, hidden by the costume. A wooden body can be quickly cut out with a saw and rounded with a rasp. A screw-eye is driven into a "u"-shaped recess where the base of the neck is to be joined in. A screw-hook in the neck itself is engaged wtih this and closed up with pliers so that it cannot come off. Arms and legs are best made from lengths of wooden dowel shaped with a chisel or penknife. Linked screw-eyes, tape or string can be used for shoulder, elbow, wrist and thigh joints, but knee and ankle joints must be made to bend only in the one direction, and no further than is necessary. A strip of leather glued into saw cuts in the ends of the two dowels make a good knee joint. The parts should be jammed together as closely as possible, and the wood cut away at the back of the knee afterwards to allow movement. A wooden tongue, best made of plywood, glued into the foot and pivoted on a panel pin through a groove cut in the bottom of the leg makes a satisfactory ankle joint, care being taken not to allow the toes to drop too far, or turn up. The tongues should be fixed at an angle to turn the toes out slightly. All joints must move very easily, the parts falling freely by their own weight.

Wood is suitable for hands and feet, but these can also be made by the papier mache method, leaving the platsicene inside to give weight. Sometimes lead soles are necessary on wooden feet for added weight, if the puppet has a stiff costume. Fingers should not be separated as the strings will get caught between them and cause a lot of trouble.

Now the puppet must be painted. This is the most exciting part of the job, and it is surprising how many weaknesses in the modelling can be concealed and how much detail can be indicated. Oil paint should be used. Flat white undercoating, such as decorators use, mixed with a little Venetian red from a tube of artist's oil color, makes a good flesh tint. A shiny finish should be avoided, as this reflects the stage lighting. The eyes and general color scheme should be exaggerated as for stage make-up.

Use thin materials for the custume, and leave plenty of room for movement. Do not clog the limbs up wtih shirt sleeves and underclothes that will not show. Dressing a marionette is quite different from dressing a doll, for some of the strings will pass through the costume, and there is no question of being able to take it off quickly. Puppets that have to change their costume during a play usually have to be duplicated. So that in fixing the costume you can use glue or nails!

THE CONTROL

All the puppet's strings go to a "control" or "perch." A cross made from two pieces of wood about 8in long held in a horizontal position makes an efficient "perch." The strings, which are of linen thread, size 18, are fastened to screw-eyes in the wood, and a large cup hook is inserted at the poinf ot intersection of the two bars, so that the puppet may be hung up when not

(Continued on Page 97)

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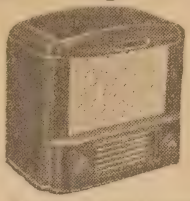

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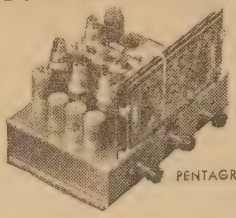

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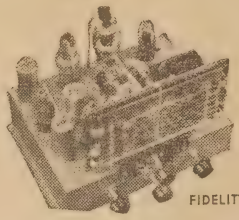
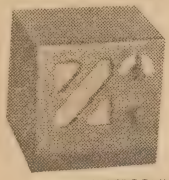
32-VOLT RECEIVER

VIBRA FIVE

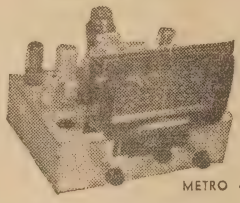


FIDELITY 5

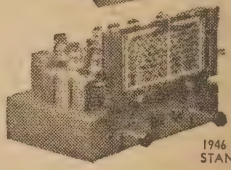
KARSET



INTERCOMM

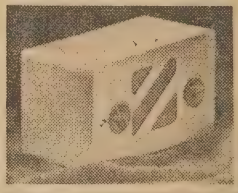


METRO 4

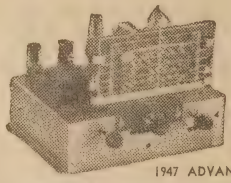


1946 STANDARD

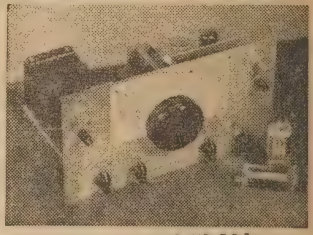
VIBRAGRAM 7



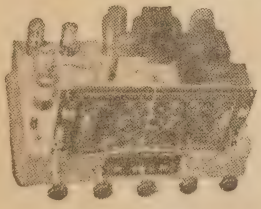
SLUMBER SET



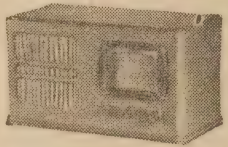
1947 ADVANCE



ALL BAND T.R.F.

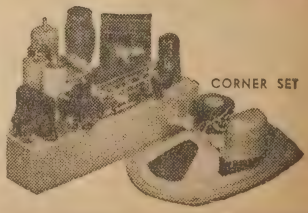


1950 RADIOGRAM



FIRESIDE 5

BEGINNERS' 1 VALVE



CORNER SET

OTHER KITS AVAILABLE:

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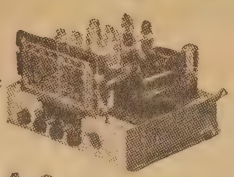
- *Pentagrid 4*
- *Electronic Parts*
- *Triple Wave Six, etc.*
- *R. & H. Kits 1 and 2*

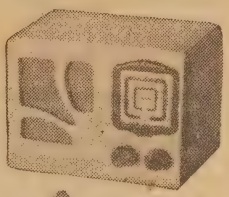
every possible purpose...

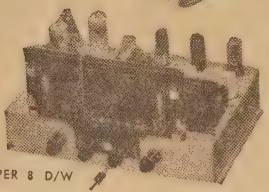
KINGSLEY DESIGNS

1947
SENIOR
OR MAJESTIC
RADIOGRAM

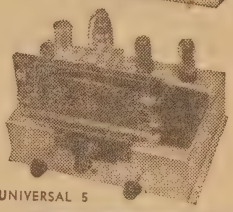


LITTLE
GENERAL



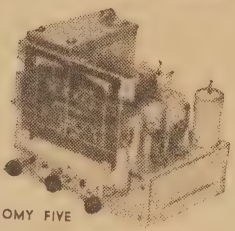


SUPER 8 D/W



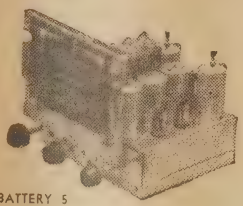
UNIVERSAL 5

SPRINGTIME
PORTABLE



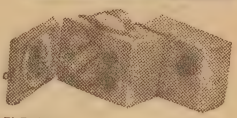
ECONOMY FIVE

CARRY
SET



ALL BATTERY 5

SENIOR
PORTABLE

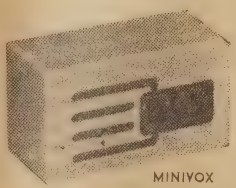


MULTI-TALKIE

6-240

HANDIE
TALKIE
4 & 5
VALVE

TABLEGRAM



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SHORT WAVE NOTES BY RAY SIMPSON

BROADCASTS FROM UNITED NATIONS

We have just received the current schedule of the United Nations broadcasts which are prepared by the Radio Division of the Department of Public Information and broadcast by various American and Canadian stations. Quite a number of these transmissions can be heard in Eastern Australia, some at good speaker strength while others are only heard with difficulty. Here is a complete list of the stations in use and also the countries to which the broadcasts are directed.

INDIA & PAKISTAN. (Saturday only).
10.45 pm to 11.0 pm Programme in Urdu, GRZ 21.64 mc.
11.00 pm to 11.15 pm Programme in Hindi, GSG 17.79 mc.

EUROPE & MIDDLE EAST. (Tuesday to Saturday).
12.25 am to 12.30 News in Icelandic, CKNC 17.82 mc. CKCX 15.19 mc.
12.30 am to 12.40 am News in Turkish, CKNC 17.82 mc. CKCX 15.19 mc.
12.40 am to 12.50 am News in Serbo-Croat.
CKNC 17.82 mc. CKCX 15.19 mc. 12.50 am to 12.58 am News in Greek.
CKNC 17.82 mc. CKCX 15.19 mc.
1.00 am to 1.27 am News in Russian, CKNC 17.82 mc. CKCX 15.19 mc.

MIDDLE EAST. (Tuesday to Saturday).
1.15 am to 1.25 am News in Amharic, WRCA3 21.61 mc.
1.25 am to 1.35 am News in Pushtu, WER29 19.98 mc.
1.35 am to 1.45 am News in Persian, WWJ40 20.95 mc.

EUROPE & MIDDLE EAST. (Tuesday to Saturday).
3.00 am to 3.05 am News in Hebrew, WRCA3 21.61 mc. WABC5 15.13 mc.
3.05 am to 3.15 News in Amharic, WRCA3 21.61 mc. WABC5 15.13 mc.
3.15 am to 3.25 am News in English, WRCA3 21.61 mc. WABC5 15.13 mc.
3.25 am to 3.40 am English programme. WRCA3 21.61 mc. WABC5 15.13 mc.
3.40 am to 3.50 am Correspondent Desp. WRCA3 21.61 mc. WABC5 15.13 mc.
4.00 am to 4.15 am B.B.C. Despatches. WRCA3 21.61 mc. WABC5 15.13 mc.
4.15 am to 4.22 am News in Dutch, WRCA3 21.61 mc. WABC5 15.13 mc.
4.24 am to 4.30 am News in French, WRCA3 21.61 mc. WABC5 15.13 mc.
4.35 am to 4.40 am Summary in Arabic, WRCA3 21.61 mc. WABC5 15.13 mc.
4.45 am to 5.00 am Arabic programme, WRCA3 21.61 mc. WABC5 15.13 mc.
Wed. and Thur. Tues. and Sat.(xx).

LATIN AMERICA & CARIBBEAN. (Tuesday to Saturday).
9.00 am to 9.45 am News and programme in Spanish, WGEO1 15.33 mc.
9.00 am to 9.45 am News and programme in Spanish, WGEO1 9.53 mc.
9.00 am to 9.45 am News and programme in Spanish, WABC3 17.83 mc.
9.45 am to 10.00 am News and programme in Spanish, WGEO1 9.53 mc.
9.45 am to 10.00 am News and programme in Spanish, WABC3 17.83 mc.
9.45 am to 10.00 am News and programme in Spanish, WRUL4 15.35 mc.
10.00 am to 10.15 am News in French and English, WRCA4 15.21 mc.
10.00 am to 10.15 am News in French and English, WRCA6 9.67 mc.
10.15 am to 10.30 am Portuguese programme, WRCA4 15.21 mc.
10.15 am to 10.30 am Portuguese programme, WRCA6 9.67 mc.
10.15 am to 10.30 am Portuguese programme WABC3 17.83 mc.

LATIN AMERICA (Tuesday to Saturday).
Noon to 1.00 pm News and programmes, WRCA4 15.21 mc.
Noon to 1.00 pm News and programmes, WRCA6 9.67 mc.
Noon to 1.00 pm News and programmes, WABC3 17.83 mc.

AUSTRALASIA (Tuesday to Saturday).
2.00 pm to 2.20 pm News and Radio Review, CHOL 11.72 mc.
2.00 pm to 2.20 pm News and Radio Review, CKLX 15.09 mc.

TRANSPACIFIC PROGRAMME (Tuesday to Saturday).
5.15 pm to 5.17 pm Programme summary. KRCA1 15.13 mc. KRCA2 9.65 mc. Honolulu 1 17.80 mc. Manila 1 17.76 mc. Manila II 15.25 mc. Manila II 21.57 mc. Manila III 17.78 mc.
5.17 pm to 5.25 pm Music. KRCA1 15.13 mc. KRCA 2 9.65 mc. Honolulu I 17.80 mc. Manila I 17.76 mc. Manilla II 15.25 mc. Manila II 21.57 mc. Manilia III 17.78mc.
5.25 pm to 5.30 pm News in Thai. KRCA1 15.13 mc. KRCA2 9.65 mc. Honolulu 1 17.80 mc. Manila 1 17.76 mc. Manila II 15.25 mc. Manila II 21.57 mc. Manila III 17.78 mc.
5.30 pm to 5.35 pm Headline news in English, KRCA1 15.13 mc. KRCA2 9.65 mc. Honolulu 1 17.80 mc. Manila 1 17.76 mc. Manila II 15.25 mc. Manila II 21.57 mc. Manila III 17.78 mc.
5.35 pm to 5.45 pm News in Tagalog. KRCA1 15.13 mc. KRCA2 9.65 mc. Honolulu 1 17.80 mc. Manila 1 17.76 mc. Manila II 15.25 mc. Manila II 21.57 mc. Manila III 17.78 mc.
5.45 pm to 5.50 pm News in French, KRCA1 15.13 mc. KRCA2 9.65 mc. Honolulu 1 17.80 mc. Manila 1 17.76 mc. Manila II 15.25 mc. Manila II 21.57 mc. Manila III 17.78 mc.

SHORT Wave Notes for the January issue are due on December 9th. For the February issue they are due on January 12. Please send them direct to Mr. Ray Simpson, 80 Wilga Street, Concord West, N.S.W.

5.50 pm to 5.55 pm News in Indonesian. KRCA1 15.13 mc. KRCA2 9.65 mc. Honolulu 1 17.80 mc. Manila 1 17.76 mc. Manila II 15.25 mc. Manila II 21.57 mc. Manila III 17.78 mc.
5.55pm to 6.00 pm News in Dutch. KRCA1 15.13 mc. KRCA2 9.65 mc. Honolulu 1 17.80 mc. Manila 1 17.76 mc. Manila II 15.25 mc. Manila II 21.57 mc. Manila III 17.78 mc.
6.00 pm to 6.15 pm News in English, KRCA1 15.13 mc. KRCA2 9.65 mc. Honolulu 1 17.80 mc. Manila 1 17.76 mc. Manila II 15.25 mc. Manila II 21.57 mc. Manila III 17.78 mc.
6.15 pm to 6.35 pm Chinese programme. KRCA1 15.13 mc. KRCA2 9.65 mc. Honolulu 1 17.80 mc. Manila 1 17.76 mc. Manila II 15.25 mc. Manila II 21.57 mc. Manila III 17.78 mc.
6.35 pm to 6.42 pm News in Urdu, KRCA1 15.13 mc. KRCA2 9.65 mc. Honolulu 1 17.80 mc. Manila 1 17.76 mc. Manila II 15.25 mc. Manila II 21.57 mc. Manila III 17.78 mc.
6.42 pm to 6.45 pm Music and Close, KRCA1 15.13 mc. KRCA2 9.65 mc. Honolulu 1 17.80 mc. Manila 1 17.76 mc. Manila II 15.25 mc. Manila II 21.57 mc. Manila III 17.78 mc.

TEST TRANSMISSIONS FROM LAKE SUCCESS

JUST as we go to press we have heard the United Nations Radio in Lake Success carrying out test transmissions beamed to Melbourne in preparation for a proposed United Nations programme in Chinese. This test transmission was heard just after 4 pm and was still on the air at 5.30 pm, and was heard on WMF38 8.92 mc, and KUH27 17.9 mc.

FLASHES FROM EVERYWHERE

CEYLON: We are indebted to the DX session from Radio Australia for details of the current transmissions from Colombo, which are as follows: 17.73 mc to Hongkong, China and Japan, from 6.25 pm to midnight; 15.12 mc to India and Pakistan from 12.10 am to 3.5 am; 21.62 mc to Burma, Malaya, South-East Asia, and French Indo-China from 6.25 pm to 3.5 am. All the above broadcasts are a relay of BBC programmes. Colombo also transmits local programmes on 9.52 mc and 15.12 mc, from noon to 5.30 pm, and on 11.775 mc from 9.30 pm to 2.30 am. None of these broadcasts seem to be as loud as they were a few months ago, though on favorable days they can be copied. This station is now controlled by the BBC.

NEW ZEALAND: We do not find the new schedule of Radio New Zealand quite as satisfactory as the one in use during the past few months. Admittedly on some days their two transmitters in the 19-metre band are very strong, but at other times it is barely possible to hear them. The old ZL8 on 9.62 mc was one of the loudest we have ever heard, and was really excellent till closing at 6.45 am. We heard that there is to be a DX session from this station on the first Tuesday of each month, from ZL3 and ZL4, at 7.20 pm. This will be a welcome addition, as our friends in NZ are in a very fortunate position regarding reception, and this will no doubt be reflected in the information given in this new session.

DENMARK: It was recently announced in the DX session from Radio Australia that there was to be a DX competition conducted by Mr. O. Lund Johansen, who compiled the well-known World Radio Handbook. Listeners are requested to compile a log of stations heard within the period of 0800 GMT on November 18, and 2359 GMT on November 19, showing date, time, frequency, call sign, country, strength, readability, programme, and type of receiver in use. All stations reported must be within the range of 9.0 mc to 12.0 mc, and logs must reach Mr. Johansen by January 1, 1951. All reports should be sent to Mr. O. Lund Johansen, Lindorffsalle 1, Hellerup, Copenhagen, Denmark.

EIRE: There always seems to be a lot of confusion as to whether this country is operating on short waves or not, as information received from the station is often at variance with what listeners in that country tell us. The latest word from the station says that they are on the air on 17.84 mc from 3.30 am to 3.50 am, and on 11.76 mc from 7.10 am. This first transmission from 3.30 am is confirmed by a US listener, though we have had no reports of reception in this country. The station says a new short-wave station is in course of construction, but Eire newspapers maintain that Radio Eireann is discontinuing its short wave operations. We shall be pleased to hear from anyone who can log this station on either of the above two frequencies.

ARGENTINA: We regularly receive from the International Broadcasting Service a very well produced little booklet, which, in addition to giving the schedule of the three stations attached to SRI, also contains many interesting articles and photographs of outstanding features of this South American republic. LRS on 11.88 mc operates from midnight to 3.0 am in Portuguese, 3.5 am to 4.0 am in German, 4.0 am to 5.0 am in Italian, 5.5 am to 6.0 am in English, 6.0 am to 7.0 am in Swedish, 7.5 am to 9.0 am in French, 9.0 am to 9.30 am in German, and finally from 9.30 am to 10.30 am in Portuguese.

The next station is LRU, on 15.29 mc, and this one is on the air from 3.15 am to 4.30 am in English, 4.30 am to 5.45 am in Spanish, 5.45 am to 6.45 am in Italian, and then from noon to 4.0 pm in Spanish.

HAVE YOU HEARD THESE?

TURKEY: For some weeks now the Turkish Radio authorities have been testing with one of their new stations, TAS, which operates on 7.285 mc between 7.0 am and 7.45 am. The entire programme is in English, and can be tuned in easily, though it is not as loud as TAP on 9.465 mc, which carries the same programme. On some mornings they use TAT on 9.515 mc instead of TAS, but generally it is the latter station.

In addition to giving the news in English they play many popular recordings and request reports from listeners as to what they would like in the programmes, and also as to signal strength of TAS. Reports should be sent to Radio Ankara, English section, Ankara, Turkey.

SOUTH AFRICA: Still new channels are being taken into use by the South African Broadcasting Corporation, all these new ones being located in Johannesburg. Here are the details, giving frequency and times on the air. 7.229 mc, weekdays 2.45 pm to 4.30 pm, and midnight to 2.30 am; Saturdays, 2.45 pm to 4.30 pm, and 11.10 pm to midnight; Sundays, 3.55 pm to 4.30 pm, and 11.50 pm to midnight. 7.275 mc, weekdays, 2.45 pm to 4.30 pm and midnight to 2.50 am; Saturdays, 2.45 pm and 4.30 pm, and 11.30 pm to midnight; Sundays, 3.55 pm to 4.30 pm 9.6 mc, weekdays, 4.45 pm to midnight; Sundays, 4.0 pm to midnight. 4.945 mc 2.0 am to 7.3 am (Sundays to 8.3 am) These latter two frequencies are used for the commercial type programmes.

MEXICO: It is some time now since we have had any word of new Mexican stations, but quite recently we heard from Art Cushen that he had been hearing XECC operating on a new channel in the 19-metre band. This station, which is located in Puebla, and is known as "Impulsoras del Progresso," is now on 15.205 mc, and is supposed to be on 24 hours a day.

There is another Mexican being heard in the early afternoon on 11.9 mc, but so far we have been unable to catch the call letters beyond the first two, XE, and frequent mention of Mexico. Perhaps some of our other listeners have been luckier, and we shall be interested to hear when anyone has identified this newcomer.

USA: Quite a number of new frequencies and changed calls this month, and quite possibly there are a few more which we have not as yet noticed. All the new ones are East Coast stations, and are as follows:—WABC, 9.67 mc, which is very good strength at 6.0 am, while the same station to 15.27 mc is also quite reasonable at 7.0 am, with European programme.

The other New York station WRCA, carries the AFRS programmes on 9.55 mc, and can be heard at 7.0 am, though there is a certain amount of interference from OLR3A. WRCA can also be heard on 9.615 mc around 7.0 am, when it carries the United Nations sessions in parallel with other stations on 11.77 mc and 15.13 mc. WGE03 is also being heard on 17.76 mc, with the same broadcasts.

MISCELLANEOUS: The American station in Tangier has now moved to another frequency, and recently has been heard at very good strength around 7.0 am, using 9.56 mc. The programmes are the usual V. O. A. relays. The Far East Broadcasting Co. station, DZB2, is now operating on 3.32 mc in parallel with the broadcast band station DZAS, and the well-known DZH6 and DZH8.

Static and interference makes this one very difficult to log. There is a new Cuban station on 9.87 mc, but beyond the fact that it is located in Havana, we have no clue as to its identity, as the quality of transmission is very poor indeed. The best time to hear this one is around 6.30 am, but it may be audible in the afternoon as well.

Radio Nacional in Lisbon, Portugal, is again experimenting to find a suitable frequency in the 19-metre band, and as we write these notes we notice they are on 15.38 mc from around 11.30 pm, close at midnight and reopen at 12.15 am. London is also using a new channel in the Pacific session from 4.0 pm. This new outlet is on 9.76 mc and comes in at great strength.

NEW STATIONS OF THE MONTH

Call	Kc	Metres	Location	Time Heard
DZB2	3320	90.36	Manila, Philippines.	9.00 pm.
Johannesburg	4945	60.67	Johannesburg, Sth. Africa.	6.00 am.
Johannesburg	7275	41.25	Johannesburg, Sth. Africa.	2.00 am.
Johannesburg	7229	41.50	Johannesburg, Sth. Africa.	2.00 am.
TAS	7285	41.18	Ankara, Turkey.	7.00 am.
WRCA	9550	31.41	Bound Brook, N.J., USA.	7.00 am:
Tangier	9560	31.38	Tangier, North Africa.	7.00 am.
Johannesburg	9600	31.25	Johannesburg, Sth. Africa.	11.45 pm.
WRCA3	9615	31.20	Bound Brook, N.J., USA.	7.00 am:
WABC	9670	31.02	New York, N.Y., USA.	6.30 am:
—	9760	37.04	London, England.	4.00 pm.
XE..	11900	25.20	Mexico City, Mexico.	1.30 pm.
XECC	15205	19.73	Puebla, Mexico.	4.00 pm.
Tangier	15240	19.69	Tangier, North Africa.	12.15 am.
WABC2	15270	19.65	New York, N.Y., USA.	7.00 am:
CSA	15380	19.51	Lisbon, Portugal.	11.30 pm.
WGE03	17760	16.89	Schenectady, N.Y., USA.	7.00 am:

LATEST VERIFICATION CARDS RECEIVED

VERIFICATIONS this month have again been very few, and as we have not heard of any received by our readers we will mention the few we have personally received.

HO50 PANAMA: The Panama station HO50, which was heard so well a few months ago, has sent along quite an attractive card confirming reception of HO50 on 6.045 mc. This station, which is located in Panama City, is operated by Radio Programas Continental, who control a number of other stations in this country. On the one side of the card is the verification data, both in English and Spanish, while on the reverse is a map of Panama, showing the location of all stations affiliated with the network.

These stations are HOHM 610kc, HO50 6.045 mc, HOC 1440 kc, HP5A 11.7 mc, all in Panama City, HOK 640 kc and HP5K 6.005 mc in Colon, HOU 1025 kc in David, HOJ 1130 kc and HOJA 9.65 mc in Chitre, HOHS 1400 kc in Santiago, HOJU 1280 kc in Aguadulce, HOMP 990 kc in Penonome, and HOJ2 1040 kc in Las Tablas.

TIFC, COSTA RICA: Although this station has, we think, already been covered in these notes, we think their present verification card and enclosures are possibly new ones. The actual card is a highly glossy one in black and white, showing a map of Central America, with a mast rising from San Jose, and the call letters TIFC and station slogan Faro del Caribe alongside.

Verification data in English and Spanish is given together with the listener's name and date of reception at the foot of the card. On the reverse side of the card they state that TIFC operates on 995 kc, with a power of 1 kw, and also on short wave 9.645 mc, with a power of 200 to 350 watts.

At the foot is an excerpt from the Bible. Another enclosure gives a complete schedule of their station, which shows that they are on the air from 3.0 pm to 10.30 pm local time, and give programmes which vary from the Metropolitan Opera Company, Light and Life Hour, Back to the Bible Broadcast, On Wings of Song, Word of Life Hour, and Quizpiration. This station is also known as "Lighthouse of the Caribbean."

DYH2, PHILIPPINES: One of the engineers at the above station, Mr. Ben Antonio, has verified our reception of the Cebu city transmitter, DYH2, which operates on 6.14 mc. He also sent us some useful data on the people to contact at other stations, which we think may be of interest. DYSR-DYH4, Mr. Bell, Silliman University, Dumaguete City; DZBB-DZ13, Mr. Bob Stewart, Manager, Escolta, Manila; DYBR-DYB2, Mr. Mario Lizares, Manager, Bacolod City; DZRH-DZH4, Mr. Ray Oliver, Manila Broadcasting Co., Insular Life Building, Manila. If you have not had any success with your requests for verifications from the above stations, we suggest you try again, sending your reports addressed to the gentlemen concerned.

BUDAPEST, HUNGARY: Quite an attractive card has been received from the Hungarian Broadcasting Corporation confirming reception of Budapest on 11.9 mc. The card is all in English, and states, "We shall appreciate your further reports, as well as comments on our broadcosts. With best thanks for your interest, we wish you good reception in the future." The card is signed by the head of the International Relations Department.

The reverse side of the card is a view of the Statue of Liberty on Gellert Hill, and is quite imposing. The address of Budapest is Hungarian Broadcasting Corporation, Brody Sandor-Utca 7, Budapest VIII, Hungary.

STATION ADDRESSES

MUNICH: Beyerischer Rundfunk, Rundfunkplatz 1, Munich 2, Germany.

BADEN BADEN: Sudwestfunk Zentrale Baden Baden, Hotel Kaiserin Elisabeth Molkestrasse 5, Baden Baden, Germany

MONTE CARLO: Radio Monte Carlo, 16 Boulevarde Princesse Charlotte, Monte Carlo, Monaco.

FETI: Radio Falange de Valladolid, Valladolid, Spain.

CR6AA: Radiodifusora do Lobito, Caixa Postal 103, Lobito, Angola.

CR6RD: Radio Clube de Huambo, Nova Lisboa, Angola.

S.A.B.C.: South African Broadcasting Corporation, PO Box 8606, Johannesburg, South Africa.

ZBW: Radio Hongkong, Gloucester Building, Hongkong.

YDI: Radio Indonesia, Studio Soerabaja, Kajoon 34, Soerabaja, Indonesia.

CFRX: Rogers Broadcasting Station, 37 Bloor Street W., Toronto 5, Ont., Canada.

CKRX: Transcanada Communications Free Press Building, 300 Carlton Street Winnipeg, Man., Canada.

HILA: Radio Caribe, Apartado 423, Santiago de los Caballeros, Dominicana.

HIT: El Hit del Aire, Apartado 1105, Ciudad Trujillo, Dominicana.

COKG: Cadena Oriental de Radio, Apartado 82, Santiago, Cuba.

BROADCAST OF MEETINGS.

DIRECT broadcasts of major United Nations meetings, when in session, with running narration in English and French can be heard from 5.0 am to 8.45 am on the following stations. WABC5 15.13 mc, WRCA 11.77 mc, WRCA 9.515 mc, WGEO 17.76 mc.

The Radio Division is anxious to establish contact with as many listeners as possible and will gladly acknowledge all communications. Letters from all parts of the world have already brought valuable information about the reception of U.N. broadcasts. All correspondents reporting on U.N. broadcasts will receive on request a U.N. Radio verification card and copy of the charter. Address to United Nations Radio, Lake Success, N.Y., U.S.A.

THE HAM BANDS WITH BILL MOORE

During the flooding of the Lachlan Valley in late October, radio amateurs were again active in providing communication circuits where required. It was the worst flood on record and higher levels were reached than during the April floods when amateurs did such sterling work.

NEW SOUTH WALES radio amateurs have had a busy time in emergency working during the past 18 months and have always supplied the necessary communication for relief work.

On Saturday, October 21, it was obvious that a major flood would occur in the Lachlan Valley, and radio amateurs in the Forbes area prepared equipment for use in such emergency. Jim Corban, VK2YC, was requested to advise the authorities, that stations would possibly apply for permission to handle emergency traffic within the following 24 hours.

By the following day telephone facilities to 300 subscribers in the Forbes area had failed, leaving the district hospital, the police and the business centre of the town out of communication. The town was divided into three "islands" by flood waters, and amateur operators operated equipment from the isolated areas.

Official PMG station VNS was contacted on 7mc and permission granted to handle urgent telephone messages in the area.

Bill Kennedy, VK2BT, operated from one "island," Jim Carr, VK2JV, from the town area itself, and was in contact with the Post Office, John Meagher, VK2AMV, from the third "island," while Hugh Stitt, VK2WH, operated from outside the town.

STANDBY EQUIPMENT

All stations, anticipating power failures, as the switch gear at the sub-station was under water, were equipped with battery operated equipment.

Stations were advised that Army "ducks" were proceeding to the area and a continuous watch was kept on the Army frequency. On arrival in the small hours of Sunday, immediate amateur assistance was requested, and VK2AMV obtained permission to co-operate with Army on October 23.

From that day onwards until the departure of the ducks on October 28 a constant watch was kept on the Army frequency of 3380 kcs, amateur stations relaying messages to and from ducks where required, besides transmitting daily reports to Army HQ in Sydney.

Later in the operation VK2WH contacted the ducks while they were operating in the Warren area and handled traffic to Sydney for them.

Although the normal town power supply did not fail a considerable amount of operation was conducted with the portable equipment to test its efficiency under emergency conditions.

The following bands were used during the operation: 3.5, 7, 14 and 50 mcs, also the Army frequency of 3380 kcs. Conditions experienced for the period were particularly poor due to aurora activity.

The whole operation proceeded with no delays. NSW amateurs certainly have gained during the last year considerable experience in emergency working.

Amateurs in the net appreciated the assistance rendered by the many stations who checked transmissions and band conditions, also the quick permission given by the PMG Department for operation.

Lessons learnt included the fact that CW operation is a must when conditions get tough, and "always be prepared"—it might happen at any time.

U.S.A. EMERGENCY

The FCC in the USA propose to inaugurate a "Disaster Communications Service" to operate in the band 1750-1800 kcs. The service is to be set up to provide communications in connection with disaster and other incidents, involving loss of communication facilities beyond those normally available.

Authorisation to operate will only be granted to applicants who demonstrate that they are an integral part of a locally organised plan. Commercial, service stations, as well as amateurs, if eligible, may be authorised to operate in the disaster service.

The frequency subdivisions as follows are proposed: 1750 to 1765 kcs fifteen one KC CW channels. 1765-1772 kcs a "scene of disaster" channel—7 kcs wide available for voice or CW, and four 7 kc voice channels from 1772 to 1800 kcs.

Frequency tolerance is 0.005 per cent and strict attenuation figures for harmonics and spurious emissions are proposed.

The service will do much to assist the work of amateurs during disasters and as a fixed organisation will provide closer liaison between them and the Police, Fire Departments and public utilities.

During October the ARRL ran a nation-wide simulated emergency test for their Amateur Emergency Corps (AEC) to promote preparedness for emergency working. In conjunction with the Red Cross, special dummy messages were originated and relayed.

The test afforded AEC groups the opportunity of renewing contact with public agencies who operate during emergencies and also gave experience to stations in areas where no operation had occurred for some time.

WIA HAMFEST

OVER the Australia Day weekend the NSW division of the WIA will run a hamfest concurrent with the WIA's National Field Day.

Commencing on the Friday evening, January 26, the normal monthly meeting night, it is hoped to arrange a demonstration of equipment at one of our biggest radio factories.

Saturday morning will be free but during the afternoon a general get-together for city and country members will be held at Federation House, Philip Street, Sydney. Commencing at 2 pm, several features will be arranged, including short lectures on interesting subjects and a demonstration of amateur equipment of various types.

A dinner at the same address will be held in the evening to which leading figures in the radio world will be invited. Emphasis will be placed on entertainment during the dinner—speeches will be cut to a minimum—and the evening should prove very enjoyable.

On the Sunday VK2WI will operate in the National Field Day from a picnic ground close to Sydney. Other teams from Sydney will also be in the field and country visitors can venture out with whichever team they so desire.

A theatre evening for the ladies will be arranged for the Saturday evening.

Tickets for the entire programme will be available in advance and all members are invited to keep the weekend clear.

The full programme will be published shortly, and all concerned with the organisation are working to make it the biggest event in the history of the NSW division.

AMATEUR FUTURE

IT would appear that decisions reached at the next two Tele-communication Conferences will decide the future of our hobby, and it is interesting to note that several national amateur radio societies appear to have changed their policies with reference to the most effective means of furthering the claims of amateur radio.

Since Atlantic City, the matter of amateur allocations is much more complex, and, with the regional system, any one nation that desires to support amateur radio can only do so effectively in its own region. Possibly with this point in view, the ARRL suggested to the 25th congress of the IARU held in Paris this year that future amateur representation at International Telecommunication Conferences be at national level. At previous conferences representatives of the IARU have attended on behalf of radio amateurs at international level.

The IARU congress rejected the ARRL's proposal, pointing out that many European societies did not enjoy the same close liaison with their governing authorities and that direct representation of amateur radio would be more effective.

The general policy of the ARRL seems to be changing to some degree. In past years under the guidance of the late K. B. Warner as general secretary and the board of directors, decisions reached were always for the betterment of amateur radio throughout the world rather than purely for the US.

Today the motion of the ARRL to the Paris conference, the cutting of the IARU notes in QST, and decisions of the board show the changing order.

The ARRL is, of course, the headquarters society of the International Amateur Radio Union and has filled that position since the inception of the union. The League has done a remarkably fine job in this position at considerable cost to its members.

The issuance of WAC certificates, calendars and the like, all take money, and under the constitution of the IARU this is borne by the HQ society. The League is, without a doubt, the leading society in the world today, and it can only be hoped that it continues to work in the international field.

To ease the burden of the ARRL as Headquarters Society of the IARU it was decided at Paris that the RSGB would run a bureau for the Union's work in Region 1—Europe and Africa.

The effectiveness of international representation for amateurs at Telecommunication Conferences by IARU delegates other than for publicity purposes is debatable. It is the vote of national delegations that decide the outcome of all proposals, so most eeffctive work can be done at home by national societies with their own authorities before the briefing of delegations.

WIA NEWS

PROFESSOR BAILEY, of the Physics Division of Sydney University, extends his thanks to all WIA members who co-operated during his recent ionospheric experiments. The Professor on the last day of the experiments journeyed to Katoomba to make observations, and these confirmed the reports of the amateur observer stations.

The Newcastle branch of the NSW division of the WIA ran in late October a contest among their members and appropriately called it the Hunter branch "scramble."

First prize was a 100TH or a pair of 809's, second an 809 or a pair of 807's.

October meeting of the branch saw president Lionel Swain, VK2CS, lecture on Low Frequency IF Transformers, and Harold Whyte, VK2AHA, on Basic Operating Procedure.

Other lectures presented at October meetings of the WIA were: Peter Mulligan, VK2ABH, who discoursed on Modification of IFF Units for 144 mc Operation, at the UHF section meeting, and Angus Robertson, VK2QZ, lectured at the general meeting on Xtal Oscillators. Angus covered his subject very fully and brought out many points of great interest to amateurs.

It has been decided to organise at the next North Coast Convention (Urunga) a contest for battery-operated stations for a trophy to be known as The Gerry Challender, VK2ZS, Memorial Trophy.

The NSW UHF sections contest on 144 mc, scheduled to be run in October, was held over to November 1 and continued over three weekends. Several numbers and reports were exchanged for points

and the scoring basis was as follows: Contacts up to 25 miles—1 point; 25 to 75 miles—3 points, and over 75 miles—10 points.

Results of the Hunter branch "Scramble" are just to hand and the first three stations' scores were very close. The winner was Jack Hill, VK2ADT, of Cessnock, and Bill, VK2CW, and Norm Smith, VK2ANA, tied in second place.

THE UHF'S

EARLY November saw many signs of the 50mc band opening for DX signals were heard from the north and north-east but were too weak to be identified. The New Zealanders broke through to their first DX for the season in mid-October. On Sunday, October 15, ZL1VP and other ZL's contacted KH6JJ between 2010 and 2115 hours EAST. The KH operates on 51.5 mcs.

A great improvement in extended ground wave operation was also recorded during October, VK2GU Canberra, VK2VU Singleton and VK2OS all being received at excellent strength. VK2PN, Tumut, and VK2TA, Young, were also worked from Sydney.

DX AND PERSONAL

ORME COOPER, VK2CP, in recent months has been doing a considerable amount of experimenting with single side-band suppressed carried transmissions and has now worked all continents on 14 mc. This WAC is certainly the first with SSSC here in Australia and possibly the world.

For the first time on record American stations have been appearing in the mornings on 7 mc. Coming the long way round at 0800 hours EAST. They have been peaking at S6, W8ULU and K1USA being particularly strong, a couple of WO appeared at one stage.

Stations in the Philippines are still not permitted to contact amateurs outside America and her possessions. DU1MB explained the position recently and stated the DU's hoped to have the ban lifted shortly.

VK1HV, Heard Island, on 14130 kcs, is very active and anxious to contact VK's. He operates at 0930, 1130 and after 1400 hours, GMT. Harry is an ex-VK4 from Townsville.

DX on 40 metres has been particularly good—some rare stations from the Mediterranean have been operating, VK2XQ collecting an IS1 while a number of 4X4's and an MD7 were contacted by other VK's.

Keith Rudkin, VK2DG, with 383 and Harold Whyte, VK2AHA, with 386, contacts in the CW section of the VK/ZL DX contest, should be up among the winners.

UHF CONTEST

THE NSW Division of the W.I.A. will hold a 50mc contest from December 16 to January 7 of next year for competition between amateurs in Australia and New Zealand.

Last season's contest was well supported and popular on both sides of the Tasman. Conditions were ideal, and some fine long distance contacts resulted from an active period of Sporadic E conditions. The only real criticism of the contest was that it was too long.

The coming contest has therefore been shortened to 3 weeks and four weekends —about half the former period. Otherwise the rules will be the same, and only minor charges, if any, will be made to them.

It is possible that the contest will be considered the Institute's Federal contest for the Ross A. Hull trophy as decided upon at the last convention. If so, certificates will also be awarded to the winner in each Division, as well as to each district winner in New Zealand.

Although there have been no DX breakthroughs at the time of writing, all are hoping that the contest will be fortunate enough to include at least one really good "free for all" as we had last time.

YOUR OPPORTUNITY —

to join the world-wide ranks of amateur transmitters! The Wireless Institute of Australia holds regular classes in Sydney to assist Sydney and suburban enthusiasts to obtain their Amateur Operators Certificates of Proficiency.

Write for particulars to the Class Manager, W.I.A., Box 1734, G.P.O., Sydney.

A COURSE IN TELEVISION

(Continued from Page 51)

stributed capacitance kept low, the ilse will have the same sharp build- followed by an immediate col- pse, as characterises the output om the more usual R/C differen- tor.

The main difference is that the quired pulses are in the reverse larity to an R/C differentiator so at, in some cases, a single stage of mplification must be used to am- ify the pulses and reverse their ase. As already mentioned, most cillators require a positive-going ilse for triggering purposes.

Figure 3 shows an alternative ar- ngement using a double wound ansformer, again having low dis- ibuted capacitance and a carefully mited inductance.

NDUCED SURGE

On receipt of a pulse, a mutually duced voltage surge appears across ie secondary winding, disappearing most immediately because the mited inductance will not allow nything like a steady-state flux ondition to be maintained over the eriod of the pulse. The output is herefore, resolved into a series of ikes, exactly as in the case of an /C differentiator.

The double-wound transformer as the obvious advantage that the hase of the secondary winding can e arranged to give the synchronising ikes the proper polarity.

A little thought will show that an nductor has the same general high- ass characteristic as the R/C filter f figure 2a. Its possible application s a differentiator is therefore ob- ious.

In all such circuits, particularly hose using inductors, it is most im- ortant that distributed capacitance e kept to a minimum consistent ith the predominant circuit imped- nce. Excessive parallel "C" limits he high frequency (therefore the ansient) response, lengthening the ise-time at the beginning of each ulse. As a result, the synchronising ikes may degenerate into some- hing resembling figure 4c, having a uch less precise triggering action n the line oscillator.

AUDIO PARALLEL

For the reader who has not had ccasion before to think in terms of ulses, there is a close parallel with ell-known phenomena in the audio eld.

The network in figure 2a is ex- ctly the same as used in any R/C mplifier and the use of unsuitable omponents will attenuate the bass nd favor the treble. The same high- ass characteristic is commonly used n tone control systems for treble oost.

The same loss of bass can be ccasioned, too, by using chokes or ransformers having inadequate in- uctance. Sometimes the effect is "accidental," as in cheap output ransformers; other times it is delib- erately arranged, as in certain bass- ut or treble-boost tone control rrangements.

If the transformer, at the same time, has high distributed capacitance, the extreme treble may be lost, as well as the bass, leading to a humped response. Any of these effects can be expressed, as you like, in terms of frequency cut-off or as the time-constants of the quantities in question.

In audio work, it is generally more convenient to think in terms of frequency response. For pulse work, where the frequencies involved are extremely high, it is easier to relate everything to time in micro-seconds . . . how quickly the voltage can rise from one value to another . . . how long a circuit takes to discharge, and so on.

Fundamentally, the problems are not new . . . they are only expressed in another language. This, the reader must learn if he is to create his own mental picture of pulses and waveforms.

In the next article we will explain the extraction of the framing pulses.

LET'S BUY AN ARGUMENT

(Continued from Page 67)

"bite." Heard on intimate terms, either directly or through a wide range system, their output is complex, demanding of interpretation. As Professor Low suggests, it may even be unfamiliar and therefore apparently distorted to the unaccustomed ear.

The point is whether there is any shame in being unfamiliar with the original sound. Is there any moral obligation to attend recitals and concerts to hear the transients and the harmonics? If there is, then there's also a moral obligation to "like" wide range reproduction.

But there's plenty of room for discussion. Why shouldn't people prefer the Hammond to a grand organ, the vibra-harp to cathedral chimes and the melodic simplicity of an electronic instrument to the complex output of an acoustic generator?

But where ARE we getting to? Having started out by espousing the cause of high fidelity, we end up excusing low fidelity. Maybe it is rather inconsistent but it's good ground for argument!

OFF THE RECORD — NEWS & REVIEWS

Far from diminishing or consolidating, so that the wondering public can settle down to plan record-playing for the future, the battle of the speeds seems to be more confused than ever. For a time it looked as though the 33 rpm microgroove records would handsomely win the day. Now, however, I'm not so sure what the outcome might be.

By JOHN MOYLE

BEING moderately long in the tooth when it comes to the analysis of projected schemes, I no longer believe all I hear or read. Otherwise I might be downcast, grimly amused, or straight out despairing to note some of the suggestions still being made about speed.

As usual, the suggestions referred to come from the USA, which is anything but conservative in these matters. In England, the Decca company is virtually in sole possession of the microgroove field, and is apparently going to town with everything it has. So far, the reception of its efforts seems to be excellent, and we have read no serious criticisms from the consumer at least.

The answer to the question—what will EMI do?—was given recently in a statement by the sales manager of the company in England. He said in effect that, for the time being, EMI did not intend to release micro-grooves, or presumably any type of groove other than the 78 rpm which has held sway for so long.

I do not think this should be interpreted as meaning that EMI has no use for 33 rpm micro-groove. It should rather be taken that the company which produces HMV, Columbia and Parlophone records —I ask pardon if I have missed any —are not yet convinced that microgroove is good enough to adopt as the standard for the next record era.

I have, of course, no means of knowing what is in the minds of EMI, but unless they have plans for an entirely new standard, which is unlikely, one could reasonably assume they have not discarded the 45 rpm standard which was sponsored by RCA, the EMI of America. Indeed, it is hard to imagine otherwise.

My main objection to the 45 rpm standard is that, if long playing is required in the sense that the 33 micro-groove records have it, a record changer will be essential as well. Now that seems an unnecessary duplication of method, or at least, a highly undesirable one.

My impression of microgroove, and my experience of it now extends to recording, is that, provided that reproduction is good, there is no greater attraction than the long playing feature without interruptions of any kind. Just to start the record and forget everything but the music for 15 or 20 minutes is something which has no substitute.

RECORDING AT 45 RPM

To demonstrate the point, I am trying to arrange a means of recording at 45 rpm, using the standard 1 mil microgroove point. The higher speed and better reproduction which may be possible as a result at smaller disc radii might give grounds for more optimism for this speed, and at least will provide positive information which is the best aid to objective thinking.

One other alternative might be that the attractions of tape recording are considered at this stage to be great enough to stage a big jump in which disc records would be bypassed altogether. Several correspondents have suggested this to me in letters received during the past two weeks.

I feel that such speculation, while highly interesting, should be undertaken with care, however, as the evidence seems to point to the disc holding the fort in the home for many years. Nothing short of unsuspected dynamite will shift the convention of the disc and the turntable at the present time.

I think, too, that it is fair to bear in mind a possible move by EMI and RCA in the production of a joint

andard aimed at replacing all those isting and projected.

If this should come about, it is gical to refer back again to the rpm speed which RCA has so ergetically plugged in America, d into which they have sunk probly millions of dollars.

Such a plan, although pure speculation once again, would have other mmercial implications not entirely vorced from the present dollar uation and the almost essential terchange of English and Ameri-n master recordings.

UBBING

Neither company, one presumes, ould be entirely happy with the cessity of redubbing records in der to cater for different standards, rticularly when the 33 speed was e brain-child of a rival concern in merica. A new model "master ayer" for 45 records of larger ze might yet alter the position ost materially, with the added traction of the higher speed and s undoubted potential for better production.

However the position at the oment is that one can only wait d see. Whether the wait will be ng or short isn't easy to say.

In the meantime, I feel that micro-oove will continue to build in, d if it is not to be followed by e major companies, then I feel the ternative cannot be announced too on.

EMI would be most foolish to be ampeded into any course it con-dered to be a wrong one, but re-rd buyers would be much happier hen they know what is in store r them. For after all, EMI and sociates are very wise in the ways recording, and their ideas must e considered with respect in this rection.

EW SPEEDS

Added point to this cautious ap-roach is given by reference to those ew speeds I mentioned earlier.

One of these is for 14 rpm, no doubt the interest of still longer play-ng. How this one is worked out n't clear to me for experience has own that quality would be very oor except with very large groove adii, and a severely restricted range ould seem almost certain.

At the present time, it is prac-cable to record two movements of lmost any long work on a single icro-groove side without sacri-cing too much at the inside, and his would seem sufficient. It could e argued I think, that, if breaks re required at all in a big work, record changer can make them ust as well as any other method. t is doubtful however, whether a lower speed would gain anything at ll.

Another suggested speed, accord-ng to report, is 50 rpm. There eems little greater reason for this han for the 14 rpm, as it so near he 45 standard as to make little ifference.

But the best of all the sugges-ions seems to be one which pro-ides for a single speed to take ll records. The author of the rize joke—or was it really sar-casm?—wants to average out all the speeds to give a new one of 52.1 rpm. This, he says, will be near enough to 45 not to matter, and one assumes that the change in the 78 records when played at the slower speed will, by giving that ludicrous effect you have observed when deliberately slowing your own turntable at a party, infuse at least some element of humor into otherwise dull records! He caps it all, and gives himself away, by further suggesting a sapphire record running in an oil bath, and played with a graphite stylus. Well—not a word to Bessie about that one!

I suppose the day will come when we will look back on our guesses and our theories with a smile in the light of an ultimate solution. That, at least, is the best comfort I can offer to those who have loaded their grouches about the position on my shoulders.

I was interested to read in an overseas magazine recently of a new patent—assigned to RCA by the way—for recording and reproducing with FM. This is done by using a carrier wave of 50kc and using its FM output to operate the cutter, which may be lateral, or hill and dale, or some other method.

The playback uses a pickup which reproduces the FM 50-cycle carrier and feeds it through a radio unit which is essentially the same as the appropriate section of an FM receiver.

Advantages claimed for the system are all those generally attributed to FM—reduction in noise, rumbles, hum, &c.

One need for the new approach is quoted as being the difficulty in arranging for a frequency range of 30-15,000 cycles by the present purely mechanical method, a ratio of 500 : 1. It is claimed that by using FM, the ratio could be reduced to 4 : 1, thus allowing greater efficiency and uniformity.

On paper, the idea looks to be a good one, but the need for special apparatus might confine it to the specialty class. One of the troubles about the ordinary disc records is their comparative simplicity as against other methods which can be considered as competitors in convenience. It's just too bad to argue it away!

PUPPET SHOW FOR XMAS

(Continued from Page 87)

in use. Fix the head strings first, making them a convenient length for manipulation. They go from the puppet's ears to the extremities of one of the bars, and should be tied off evenly so that when you rock the control the puppet will shake its head. Next fix a string from the small of the back—use a staple or screw-eye through the costume for this—to the extremity of the other bar, making it just taut when the control is in a horizontal position. When you tilt the control forward the puppet will bow. Try tilting it and rocking at the same time—he will lean forward and turn his head from side to side.

Leg strings may be arranged in a similar "run through" manner through a screw-eye on this same bar, rather nearer the centre; but it is more efficient to have a separate bar for the legs which is hooked by a string loop over the main cup hook and may be quickly taken off when required. The leg strings are fixed one to each end of this bar, and come from just above the puppet's knee. To make the puppet walk, hold the crossbar in one hand and move it forwards with a slight up and down movement, rocking the leg bar, to pull alternate legs, in the other. Walking is by far the most difficult feat for a puppet and requires a great deal of practice. You will find dancing to a gramophone record much easier.

FROM THE SERVICEMAN WHO TELLS

(Continued from Page 70)

These are the "credit" entries in your "Double Entry" bookkeeping system—where are the "debit" entries?

In the case of goods purchased for resale you will see that these are all entered in the Purchases column of the Purchase Book. We ask ourselves the question what account received the goods?—the answer is Purchases Account.

Although you had to make four separate postings to the individual firm accounts (in order to show how much you owed each one) one posting only is necessary to record your total purchases for the month, i.e., the total of the Purchases column, viz., £79.

INDIVIDUAL ACCOUNTS

You then proceed to debit the individual expense accounts advertising, &c., and Plant in the same way. If you have posted correctly you will have debited the various accounts with a total of £105. This agrees with the total posted to the seven credited accounts and this completes your Double Entry.

Figure 3 shows you a specimen Sales Book. The procedure to be adopted in entering the Sales Book in one important respect. Do not wait until the end of the month to enter up the invoices. I refer to Sales Invoices, i.e., the ones you make out and give your customer for the work you have done for them or stock you have sold them on credit.

It is essential that you have an up-to-the-minute record of all amounts owing to you. Therefore each invoice you give should be entered separately in your Sales Book. Make this a daily practice.

ESSENTIAL RECORDS

Three columns only will be required in your Sales Book—Sales, Service, and Total. This is so because Sales and Service will be the only two types of transactions for which you will be issuing invoices.

As far as posting is concerned, the opposite procedure to that employed for the purchase book applies. You have sold goods or done work for a number of people. They have received the goods or service and therefore their accounts are debited—they have become your Debtors. It is from these people you have to get your money to pay your Creditors, so be wise in your choice of credit customers.

Trace each of these postings into the personal accounts. You have the folio numbers to guide you.

Regarding the credit posting from the Sales Book, only two are required each month, viz., the total of Sales and the Service total. This month they total £165, which is what all the debit postings to the individual Debtors accounts add up to.

You may desire to send statements out at the end of each month as a reminder to each debtor as to what he owes you.

If you wish to do this it is necessary to turn up each debtor's account, add up both sides and determine the balance. This amount goes on the statement.

Should you adopt this practice—and if your business grows it will be essential—always send your statements out as soon as possible after the end of each month. You cannot expect prompt payment if you do not render your accounts promptly.

You will recall that earlier in this article we saw that Credit Accounts involved two transactions, viz., the actual purchase or sale and payment for same.

Up to the present we have confined our attention to the original transaction. Should, however, say, J. Kent, who bought goods from you on October 19, value £28, pay for them on October 28, this will be recorded on the Receipts side of the Cash Book and subsequently posted to the credit of J. Kent's account, thus squaring it.

Conversely when you come to pay the Y. Radio Co., the payment will be shown on the Expenditure side of your Cash Book and posted to the Debit of the Y. Radio Co.'s account.

At a later date should the volume of your business warrant it, you may find it more convenient to have separate Ledgers for your Debtors and Creditors.

GROUPING ACCOUNTS

This simply means dividing up your Ledger and keeping all your Debtors Accounts together in one book and your Creditors in another.

For the immediate present I do not consider this necessary.

In the next article which will be the last in this series, "Elements of Bookkeeping," I propose to take out a statement of your bookkeeping to date and also to show you how to prepare a Profit and Loss Account.

SALES BOOK

Date	Details and Invoice No.	Folio	Total	Sales	Service
Oct. 2	J. Jones 101	P. 21	35	35	
" 10	S. Smith 102	P. 22	4		4
" 11	T. Harris 103	P. 23	8	8	
" 19	J. Kent 104	P. 24	28	28	
" 22	K. Barry 105	P. 25	33	30	3
" 27	J. Jones 106	P. 21	4		4
" 27	S. Smith 107	P. 22	24	24	
" 30	T. Harris 108	P. 23	29	26	3
			£165	151	14
				Page 2	Page 3

Fig. 3.

PURCHASE BOOK

Date	Details	Folio	Total	Purchases	Advertising	Stationery	Freight	Plant
Oct. 30	L.M. Radio Co	P. 12	20	18			2	
	O.Z. Battery Co.	P. 13	16	16				
	T.V. Speaker Co.	P. 14	5	5				
	The Valve Manufacturers Co.	P. 15	40	40				
	Quick Printing Co. Ltd.	P. 16	7		7			
	Stationery Sellers Ltd.	P. 17	6			6		
	Y Radio Co.—Test Instruments	P. 18	11				1	10
			£105	79	7	6	3	10
				Page 4	Page 9	Page 19	Page 20	Page 7

Fig. 1.

FOR THE JUNIOR EXPERIMENTER

(Continued from Page 39)

high or medium selectivity. Any mystery? Not a bit.

All they have to do is to push the windings further apart and perhaps cut down the L/C ratio.

Take it a step further, by pushing the L/C ratio way back, and keeping the coupling tight and, presto, you have your low-gain medium-selectivity transformers.

Then there's the matter of short-wave tuning coils. If you're building up a real "hotcha-dotcha" amateur set, with hand trimmers and big coils, just keep the primaries well away from the secondaries — nice loose coupling. Do this and the trimmers peak sharply, the images drop away and the whole set feels really good.

But put the same coils in a dual-wave set and you'll go grey trying to make them track. To save this premature ageing, the designers usually interwind the primaries, keeping the gain up but flattening the peak so much that it hardly matters whether the circuits are in line or not.

SUMMARY

Now let us summarise all this in a few simple facts about coils.

1. A tuned circuit consists of an inductance or coil (L) connected to a capacitance or condenser (C).

2. The resonant frequency of the circuit occurs when the inductive reactance (XL) balances out the capacitive reactance (Xc.). These two reactances are opposite in sign—that is, one may be considered positive and the other negative.

3. The same resonant frequency can be achieved by a large coil and small condenser, or by a smaller coil and a larger condenser. In each case, their reactances must cancel out.

4. As all coils have resistance (R) the circuit at resonance represents a pure resistance.

5. For maximum gain, the circuit must have a high "AC resistance" or impedance (Z). This means a large coil and a small condenser.

6. A good coil is one with a high ratio of reactance to resistance—that is, high reactance and low resistance. This ratio is called "Q". For high selectivity, a circuit must have a high "Q". The inclusion of a resistance across the circuit will decrease the selectivity.

7. When two coils are coupled together as in a transformer, wide spacing gives low gain and high selectivity. Moderate or "critical" spacing gives good gain and selectivity. Close spacing or over-coupling gives high gain but poorest selectivity. The symbol denoting the coupling factor is M.

There are plenty more things to know about coils, condensers, and circuits. For instance we have considered only parallel tuned circuits, although we frequently find circuits where the coil and condenser are in series. But most of them are based on the simple matters we have discussed, and about which there is really very little mystery!

MIRACLE OF SIGHT

(Continued from Page 15).

Viewed at greater distances the image focused on the retina is smaller and two or more picture elements may fall on one cone. The brain registers these, not as separate elements, but as one because only one nerve fibre is involved. Thus details of the picture are lost. In television the distance at which this loss of detail becomes evident is called the critical viewing distance.

Space does not permit of much further discussion of this interesting matter. However, a few remarks regarding flicker may be of interest. The property of the eye called persistence of vision is a peculiar one and a fortunate one for television engineers.

PERSISTENCE

The sensation of light persists in the eye for a short while after the stimulus has been removed. The sensation then gradually dies away.

It seems that this persistence of vision is about one-fiftieth of a second so that in a motion picture the light impulses are projected to the eye at a rate of about 50 per second.

When the impulses are projected at a slower rate flicker is apparent because the action of the shutter, which covers the picture while the film is moving to the next frame, becomes visible.

Flicker is less noticeable if the light intensity is reduced. This appears to be caused by the fact that under such conditions the cones in the centre of the retina go somewhat out of action and the function of sight is transferred more to the rods on the outer edge of the retina. These rods are more sensitive to dim light.

Even at reduced brightness the flicker is apparent if the impulses are sent to the eye at fewer than 30 per second. Television makes use of this fact by transmitting all the picture elements of a picture in one-thirtieth of a second. As a television picture contains about up to 200,000 picture elements it means that up to 6,000,000 elements must be transmitted in one second.

YOUR ANSWER, TOM

(Continued from Page 63)

the 3-inch job, it's usually fitted with. You'll be amazed at the difference.

Of course, it's obvious that you can't have 12-inch speakers on portable sets, leastwise not unless you want something the size of a suitcase. As a compromise, some of the bigger and more efficient portables, like our "Senior Portable" use a 7 or 8-inch speaker, which is nearly as good as a 12in, better than a 5in, and a heck of a lot better than a 3in pip-squak.

So there it is, Tom. Given speakers of equally modern design, it's always the best plan to use the largest one you can conveniently house in the cabinet. Far from being harder to drive, they're generally a good deal more sensitive.

ANSWERS TO CORRESPONDENTS

F. F. (Redfern, NSW) sends in an ad. and also mentions that resistance coupling was not found to be effective in a small battery set.

A. Many thanks for your further letter on the subject. The fact that the resistors were new and that they also operated in an a-c set removes the possibility of their being faulty. However, our original remark still stands good, namely that the insertion of a resistor in the plate circuit of a detector may have so lowered the voltage that it failed to oscillate. This would have made an enormous difference to the sensitivity of the receiver. However, we agree that in a very small set of this type, transformer coupling is the best proposition.

B. C. (Regent, Vic.) forwards a rough sketch of a small transmitter and asks where he might obtain the components necessary for its construction. He also asks how he can go about obtaining an Amateur Operators Certificate of Proficiency.

A. Well, B. C., we feel that you should be able to obtain the necessary components at almost any of the large radio supply houses in Melbourne particularly those who cater especially for the needs of the radio amateur. It is wise to bear in mind, however, that the possession of any transmitting equipment without the holder having an A.O.C.P. and a transmitting station licence would be in contravention of PMG regulatioins. The amateur transmitter's licence is issued by the PMG Department after the applicant has qualified at the A.O.C.P. examinations. These examinations are normally held each quarter in the Capital cities but arrangements can be made by the applicant to be examined at the official post office in country centres. The applicant is required to answer satisfactorily examination papers on radio receivers and transmitters and also regulations covering the operatioin of an amateur radio station. Last, but not least, he must demonstrate his ability to send and receive morse code at a speed of 14 words per minute. A syllabus setting out the scope of the examination paper is available on application from the Wireless Branch, GPO, in each capital city while specimen papers from past examinations are available from the same source at a small charge. Books recommended for study include the Admiralty Handbook and any one of the shortwave handbooks published by the A.R.R.L., the "Radio Handbook" or a similar book published by the R.S.G.B. If the applicant is successful in passing the A.O.C.P. examination, he is entitled to apply to the Wireless Branch for the issue of a station licence and callsign which will entitle him to set up an amateur station.

J. W. E. (Concord, NSW) asks a few questions arising from recent articles.

A. The recent article on diamond stylii inferred that the life of sapphire stylii was much more limited than other published tests would indicate. However, irrespective of the actual quantities involved, diamond stylii have a lot to recommend them. Objections of higher cost and more difficult polishing have restricted the supply as yet but we would not be surprised to see them developed on a larger scale for home use. At the moment we cannot suggest a source of supply. Jewel stylii should be changed round in the chuck very frequently or not at all. Occasional changes between lengthy playing periods would allow flats to develop and cause damage to records played subsequently with the "flat" at an oblique angle.

C. V. G. (Mascot NSW) sends us a circuit and details of a set which he has constructed, and requests our general comment, and some advice about one or two points.

A. Thanks very much for your circuit and details C.V.G., and you certainly seem to have some very nice gear. As you say it can be expensive, but is usually justified. The cathode resistor values are inclined to be on the low side, the 6J7 and the 6SJ7 usually requiring values of about 2000 ohms.

A possible criticism of the set-up is that the audio gain appears rather high, thus necessitating the use of separate power supplies, while it may have been posesible to obtain identical results with less gain, and so operate the whole arrangement from the one supply. Also, while the single ended output stage is no doubt capable of giving adequate volume, a push pull stage has a number of advantages, such as reduced distortion in the circuit itself, and also providing better working conditions for the output transformer, by minimising d.c. saturation of the core.

Nevertheless the whole arrangement is no doubt capable of giving a very good account of itself, particularly with good programme material, such as live artist performances. The price of long playing records may at first appear high, but when the playing time is considered it is really very little different from the price of standard records. It must also be realised that large sums of money have been spent in developing this system, and the manufacturers are entitled to recover at least some of this outlay.

YOUR QUERY?

1. Queries will be answered in rotation through the columns of our magazine if not accompanied by a fee for a postal reply.
2. Queries, neatly and concisely set out, will be answered by mail as quickly as possible if accompanied by 1/- in postal notes or postage stamps. Endorse envelope "Query."
3. Back numbers are rarely available but reprints of most circuits, wiring diagrams, and parts lists will be supplied for 6d each, minimum charge 1/-. Thus a circuit, layout, and parts list will cost 1/6 in stamps or a postal note. Endorse envelope "Circuit."
4. Blueprints of exact size chassis layouts with all essential holes, and cutouts will be supplied if available for 2/6. Endorse envelope "Blueprint."

Address your letters to the Technical Editor, "Radio & Hobbies," Box 2728 GPO, Sydney.

H. M. (Milton, Qld.) has been an interested reader of Radio and Hobbies for the past three years and writes to compliment us on the magazine and also to tell us of some of his activities in the radio field.

A. Very many thanks for your letter which was read with interest. You will probably have realised by now that the search for high fidelity is almost never ending. However, improvements that are being made in the laboratories of large manufacturers are being passed out in better mass produced articles bringing better fidelity into the reach of the average experimenter. We agree that the records themselves are one of the weaker links in the present chain of reproduction but since a fortune is tied up in the present machines a change cannot come either quickly or easily. At any rate, we hope that we will be able to continue to supply you with the latest authorative information on the subject and also that your proposed system will soon be working to your satisfaction.

J. J. (Kunonoppin, W.A.) wants some information about swimming pools, and asks if it is possible to make a small pool from papier mache and plaster or paris, and if so how to waterproof same.

A. We regret that we are unable to help, as this is quite outside the scope of this service. However, if any of our readers are able to help, they may care to drop us a line.

J.K. (Ballina, NSW) suggests that we describe a reflectory type telescope in Radio and Hobbies.

A. A small number of readers may be interested in the project J.K. but we cannot make any promises at the moment.

A.M.S. (St. Kilda, Melbourne) notifies a change of address and says he is very interested in the current series of television articles.

A. We have made a note of your new address as requested. Glad you like the television articles and other features mentioned. The noise limiter is well worthwhile in any location where auto ignition interference is a problem. In some of our UHF work in the city, it has made all the difference between signals and no-signals.

G.W.S. (Nowra, NSW) has been away from this country for some time and is anxious to catch up on back instalments of A Course in Television.

A. We regret that we cannot assist you directly as we find it impossible to keep back numbers for more than three months. It would be possible for you to get photographic copies of all the pages making up the course from the Public Library but it is likely to be rather expensive since the charge for the normal sized prints of Radio and Hobbies pages is 1/-. If you are interested address your inquiry to the Principal Librarian, Public Library of NSW, Macquarie Street, Sydney. The course started with the June 1949 issue.

J.L.W. (Clifton Hill, Melbourne, Vic.) says that in representing three regular readers, he would like to see described a Signal Tracer and a Modulated Oscillator.

A. Taking the Signal Tracer first, the July, August and September, 1943, issues of R & H carries articles on this item of equipment, complete with circuit diagrams of simple types through to the more elaborate types. Also, in the June, 1947, issue, there appeared a circuit diagram of a signal tracer made up from an old TRF set. Coming to the second item of equipment, the Modulated Oscillator, the April, 1947, issue described a handy Service Oscillator in a battery-operated version, while the following issue, May, 1947, described a mains-operated version of the same oscillator. This Modulated Oscillator covers a range from 150 kc to 30 mc in five switched bands.

P.W.W. (Blacktown), wants to know if he could use an 83-v rectifier in an old version of the "Little General."

A: This valve could be used in place of an 80 without making any necessary alterations in the circuit. The main difference between the two valves is that the 83-v has a larger d-c output than the 80, which may not be important in this case. Although we don't as a rule include a magic eye tuning indicator in all our circuits, it could easily be added if desired to any receiver having an A.V.C. system.

J.M. (Mosman), has built up the Little Jim's Mate with considerable success, but is troubled with band capacity effect.

A: This is rather a difficult problem to obviate with these small sets unless you are prepared to fit an earthed metal panel. However, often by using a short, direct earth its effect can be reduced to a minimum. By connecting the .00005 mfd. condenser in series with the aerial lead, or even shortening the aerial, should enable you to tune down to the stations at the high frequency end. Thanks for the appreciative remarks and glad to know you enjoy reading "Radio and Hobbies."

M.W. (Hurstville), suggests we mark on our circuits the various voltages applied to each valve.

A: Thanks for the suggestion. However, it involves quite a lot of extra work which is a vital concern at the moment. The valves used in most of our circuits are worked at the standard ratings, and much help can be obtained by referring to an ordinary valve data chart.

Readers say:

I think it was a representative of H.M.V. who, a year or so ago, had occasion to talk to a group of engineers on the design of domestic electric gramophones. One of his themes was roughly—"it is easier to record than to reproduce"

He proceeded to the limiting case and depicted with the chalk the familiar square wave shape. The impossibility of the situation assumed made me think more about it.

That a system which works so well with a mixture of tones and transients through a wide range of frequencies and phase angles should be approaching such a limit seemed unlikely.

Then you came in, with your mention of "right angled displacements in 'Off the Record'" in August last. I submit that the following consideration is nearer the truth.

If you consider your pickup as a device which translates rate of displacement of the needle point into output voltage and then by magic make it follow a "square cut," what is the output?—A series of pulses of infinitely large amplitude and infinitely small duration. Unaided, a pickup would give a true evaluation of the situation by giving an output of zero as suggested in your paragraph.

If a square wave OUTPUT is desired, the cut on the record would have to be a triangular wave. What is more, it would probably be found that the angle which the groove makes with the straight need not exceed 45 degrees at any frequency. On a constant velocity recording, this angle is a function of the level of the recording and is independent of the frequency.

In the terms of the differential calculus it can be said that the function representing the sound output wave is the result of differentiating the function representing the sound track wave. Thus a triangular track gives a square output, a sine wave track gives a sine wave output (differentiating a sine wave does not alter the shape, only the phase angle).

This brings up the point—how many have realised that, for a sine wave shape, when the needle is crossing over the zero line of the track, the output voltage is going over the top.

Similarly a cutting head will cut a triangular wave when fed with a square wave and the displacement of the reproducing speaker cone would, if plotted, be triangular. Both of these devices, when loaded, under dynamic conditions are displaced at a constant velocity during the period of constant applied voltage just like constant speed shunt wound electric motors. This depends on the damping force during displacement being small compared with the driving force and the load.

Getting back to the square sounds where we were faced with a triangular wave. This has acute or obtuse angles. Is it reasonable to expect the stylus to bang up against the end and be brought to rest and then reversed? It need not be necessary.

Surely if recordings were cut so that the track shape required to be differentiated twice to get the output, this could be avoided All sharp corners would disappear, leaving only continuous curves for even the most complex (i.e., square) sounds.

The triangle gives way to a constant acceleration curve—sine waves still remain sine waves. If the pickup now delivered a triagular wave to be handled by the amplifier, we could feed this into a speaker which displaced its cone in proportion to the applied voltage, thus performing the second differentiation.

L. H. Lambkin (Arncliffe).

COMMENT

Mr. Lambkin has raised some interesting points in this letter, although we don't quite see eye to eye with them all.

Fed with square waves, a cutter would attempt to cut a rectangular pattern, modified, of course, by the forward groove speed. It continues to give "output" during the flat tops of the wave because the stylus holds its displacement, while the input maintains a potential across its terminals. Remove the potential, or reverse it, and the cutter flicks back to the "at rest" or the reverse displacement as speedily as its acceleration characteristics will allow.

If a reproducing stylus could be forced to follow this square wave track, the output would, indeed, be resolved into "spikes," its velocity/output law imparting to it the characteristics of a differentiating circuit. Therefore, for square wave output, the track shape would indeed be more like triangular.

There would thus appear to be a fundamental discrepancy in the behavior of cutters and pickups which would, in the ultimate, produce selective phase rotation of the high order components in a complex wave.

As for the loudspeaker, it does attempt also to produce square wave cone movement, being limited by acceleration and overshoot characteristics. However, acoustic conditions would combine to limit the "hold on" period and give a more triangular stimulus to the listener.

How about an argument on this one?

America has color television

(Continued from Page 7)

than half this figure, and, therefore, forces it down into outdated screen sizes.

For a 16-inch picture a disc about three feet in diameter would be required, and with a periphery speed of just over 160 mph.

While this is clearly unacceptable, it does not alone provide grounds for rejecting the CBS system. A color wheel presents much less difficulty with the smaller projection type tubes, so that large-screen projection type pictures would appear to be immediately practical. However, this is at variance with present design trends.

Columbia point out, however, that the disc is not an inevitable part of the system and they have already demonstrated all-electronic reproduction using similar tubes to those suggested by RCA.

The most serious objection, it would seem, is the coarser line structure, which is particularly noticeable on the monchrome reproduction. In this respect the results are far below those at present obtained from the standard 525-line transmissions. This limitation is inherent in the bandwidth which the standards impose, and monchrome reproduction for cheap sets will be forced into the very mediocre class.

However, wisely or otherwise, the FCC has made up its mind and announced the standards. This is just about as far as it can go. Only the trade and the public can determine the degree to which it is implemented.

The "green light" takes effect as from November 20 and the CBS stations are planning for a half-hour of color somewhere in the 6-8 pm schedule, with perhaps another half-hour at the close of the evening's entertainment. This assumes, of course, that no court injunction is obtained to prevent commencement of the service.

It is certain that few of the large manufacturers will play ball immediately with the converter idea, but some of the smaller manufacturers may do so and get adaptors and converters out by early January. Until they do, there will be virtually no color audience among the general public. In fact, it has been stressed that the public has not even witnessed the demonstrations to any extent, decisions and impressions being confined mainly to technical and interested parties.

But the public is certainly in a spot. Up to now, it has been clamoring for receivers and more receivers. Suddenly, every set on the market is threatened with obsolesence and the CBS president has hinted darkly that buyers would be wise to wait another six months. At the very least they should see that any set they buy can be readily adapted to the new standards.

But, as he opens the Sunday paper, Mr. US is faced with a full-page

(Continued on Next Page)

AMERICA HAS COLOR TELEVISION

(Continued from Previous Page)

statement from Raytheon television giving him the straight facts.

It makes points like this:—

1. The FCC cannot compel stations to switch to color.
2. Only CBS supports the proposed system. The NBC, ABC and Dumont networks do not intend to adopt the new standards at the present time.
3. The FCC cannot stop the development of other systems, nor does it intend to do so. It is entirely possible for another system to be adopted at a future date.
4. The FCC decision was not unanimous. While the Columbia system gave the best color, the all-electronic systems had better detail and less flicker.
5. Black and white television will get all the top shows for years to come. Today's television receivers will be predominant for many years, even if color goes right ahead.

In a statement of policy Raytheon says they will continue to turn out standard receivers, but with a provision for a plug-in adaptor, which you can buy if you want to. They are designing the adaptor and may even produce a converter to go with their new sets. These could give you CBS color but, if you are wise, you'll forget all about color television until the position is straightened out.

That sums up the position pretty well as the US television trade sees it.

America has got color television—or has it?

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A.C. VOLTAGE SCALES MADE LINEAR

(Continued from Page 69)

sistance of value greater than is necessary is coupled in series with the circuit. A variable source of AC is required, together with a reliable AC voltmeter.

The equipment is set up as in Fig. 4, and the variable series resistance adjusted to give a full-scale reading which agrees with that on the standard meter. Next, the linearity is checked by varying the AC supply from maximum to zero, the compensating variable resistors R1 and R2 being adjusted to preserve the linearity. When the meter is linear from zero to full-scale, the series variable resistance is measured to give the value of resistance in series with the meter.

This procedure is then carried out for all the other required ranges, with the exception of the adjustments to the resistances R1 and R2, which are now set for all ranges. The value of resistance in circuit, which is provided by the variable series resistor, is the value required as a fixed resistor on each range.

The instrument may be calibrated as an ammeter by coupling a variable resistance across the rectifier AC terminal and by using a standard AC ammeter in series with the variable AC supply leads (Fig. 5).

A procedure similar to that of the voltmeter calibration is used, and here again it is unnecessary to adjust R1 and R2. The value of resistance in parallel with the circuit is that which is required to give full-scale deflection when the standard meter and the instrument being calibrated agree.